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THE PRACTITIONER.

JANUARY, 1884.

Original Communications.

HISTOLOGICAL LESIONS OF THE KIDNEY IN ALBUMINOUS NEPHRITIS.

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I.

In a former communication to the *Practitioner*[1] I tried to give a description of the lesions observed in the acute nephritis which is consecutive on infectious febrile diseases, typhoid fever, erysipelas, scarlatina, &c., and which is usually temporary. I now propose to finish the study of the histological changes in the kidney in albuminuria by studying the forms of permanent albuminous nephritis, that is to say chronic parenchymatous nephritis and interstitial nephritis. In order to understand better the problem which we are about to examine, we must take a short retrospective glance at the history of the disease.

In 1827 Richard Bright discovered the disease which bears his name, and recognised the relation which exists between albuminuria and certain lesions of the kidney. He described three different anatomical forms of chronic albuminous nephritis

[1] February, 1882.

without giving a definite opinion as to whether these were three distinct renal affections, or three stages of the same affection.

Christison, Gregory, Elliotson, Copland, &c., brought observations in support of Bright's discovery. Rayer studied the pathological anatomy of albuminous nephritis more precisely, and in his work on diseases of the kidney[1] he describes six forms of nephritis, the two first of which belong to the class of transient albuminous nephritis, and the last to that of permanent albuminous nephritis. Rayer considers them to be different stages of the same morbid processes. In 1838 Martin Solon reduced the number of anatomical forms of the disease to four.

But already the microscopical study of lesions of the kidney and of urinary sediments had commenced. A. Becquerel noticed hypertrophy of the Malpighian corpuscles in 1841, and Fluge, Henle, Vogel, and Canstatt made some unimportant microscopical observations.

William T. Gairdner[2] and George Johnson[3] utilised the discoveries of Bowman regarding the intimate structure of the kidney in their study of the pathological anatomy of the organ.

Virchow,[4] Reinhardt,[5] and Frerichs,[6] took up the question in turn. For a long time the treatise of Frerichs remained the best on the subject. He distinguished three stages in albuminous nephritis :—

(1) The stage of hyperæmia and of commencing exudation.

(2) The stage of exudation and of metamorphosis of the exuded products.

(3) The stage of atrophic regression.

[1] *Traité des Maladies du Rein.* J. B. Baillière, Paris, 1839-41, 8vo; and *Atlas* in folio, 1837.

[2] *Contributions to the Pathology of the Kidney.* Edinburgh, 1848.

[3] *Medico-Chir. Transact.* vol. xxix. p. 1; vol. xxx. p. 165; and Todd, *Cyclopædia*, art. "Rein," Johnson, édit. Allemande, "Die Krankheiten der Niere-traduct. Schutze." 1854.

[4] Virchow, quoted by Nieman, *De Inflammatione renum parenchymatosa*, Berlin, 1848; et Virchow's *Archiv*, t. iv. 1852, pp. 261-325.

[5] Reinhardt, *Deutsche Klinik*, 1849, No. 5; *Annalen der Charité zu Berlin.* 1850.

[6] *Die Bright'sche Nieren-Krankheit und deren Behandlung.* Braunschweig, 1851.

According to these authors the alterations in the renal epithelium are of primary importance, and the lesions of the connective tissue are regarded as simply the last stage in the progress of the disease.

The treatise of Rosenstein gives a *résumé* of the earlier works.

With the researches of Beer, Traube, Samuel Wilks, Handfield Jones, and the more recent ones of Lecorché,[1] Kelsch,[2] Lancereaux,[3] and Charcot,[4] the study of albuminous nephritis enters upon a new phase: the lesions of the connective tissue become more important, and two types of albuminous nephritis are finally recognised, differing in their pathological anatomy and clinical characters,—parenchymatous or epithelial nephritis and interstitial nephritis.

In regard to the clinical characters which distinguish parenchymatous nephritis we find that the symptoms are œdema, anasarca, and diminished quantity of urine, which is turbid and dark-coloured, contains much albumen, and yields an abundant sediment of hyaline casts. The course of the disease is frequently rapid, and it is frequently terminated by pneumonia, gangrene, or erysipelas of the œdematous parts. The development of the disease is markedly increased by cold and wet, and the subjects of it are generally young.

Interstitial nephritis, on the contrary, is characterised by the fact that œdema is absent or hardly perceptible; the urine is abundant, clear, and pale, it contains little albumen, and few cylinders. The disease is slow in its progress, it is often complicated by hypertrophy of the left ventricle, albuminuric retinitis, and hæmorrhages from different parts. It usually terminates in uræmia. The predisposing causes are gout, lead poisoning, and alcoholism, and the subjects of it are usually beyond middle age.

In regard to the pathological anatomy of parenchymatous nephritis, we find that the kidney is bulky and soft, that the cortical substance is voluminous and pale, and that the lesions

[1] *Traité des Maladies des Reins et des Altérations pathologiques de l'Urine.* 1875.

[2] *Revue critique* in *Archives de Physiologie normale et pathologique.* 1874.

[3] "Maladie de Bright" (*Dict. Encycl.* 1871); article "Reins" (*Dict. Encycl.* 1875).

[4] *Leçons sur les Maladies du Foie et des Reins.* 1874.

chiefly affect the renal epithelium. This is the large white kidney.

Interstitial nephritis, on the contrary, is characterised by a small kidney, with a very adherent capsule, the surface is of a red colour, and studded with granulations. Section shows that the atrophy chiefly affects the cortical substance. The chief seat of the lesions is the connective tissue. This is the small red kidney or the granular kidney.

Such, in a few words, is a description of parenchymatous, compared with interstitial nephritis. Does this distinction, this opposition between the two varieties of albuminous nephritis both in pathological anatomy and in clinical characters, really exist? I have no hesitation in saying that it does not.

The exceptions to this rule are so frequent that it is impossible to maintain so sharp a division, and the truth is that these two varieties of nephritis are almost always associated together, but in different proportions; in some cases the lesions of epithelial structures predominating, and in others the lesions of the connective tissue. This is the result which comes out clearly from the numerous observations that I have made during several years, and it is the result also of the labours of Weigert [1] and Wagner.[2]

Several of the authors who have embraced with the greatest ardour the twofold subdivision of Bright's disease into parenchymatous and interstitial nephritis, have given up their first opinion; especially is this the case with Kelsch,[3] who, after formerly supporting the principle of duality, has considerably modified his old opinions in a treatise which he has published, along with Kiner, on lesions of the kidney in intermittent fever.

We shall soon see that the majority of cases of parenchymatous nephritis present very important alterations in the connective tissue; both the membrana propria of the tubules, and the connective tissue which surrounds them, exhibit thickening. On the other hand, in all cases of interstitial nephritis, accompanied by albuminuria, there are lesions of the

[1] *Die Bright'sche Nierenerkrankung vom pathologisch-anatomischen Standpunkte: klinische Vorträge* (162-163), *innere Medicin*, No. 55.

[2] *Deutsches Archiv für klinische Medicin*, vol. xxv.

[3] *Archives de Physiologie normale et pathologique*, Feb. 1882.

renal epithelium, as evidenced by turbidity, or by a vesicular condition or fatty degeneration of the cells, or by intratubular exudation and hyaline cylinders.

If pathological anatomy shows us this constant mixture of lesions, affecting at the same time the epithelium and the connective tissue; if this science cannot subdivide Bright's disease into two distinct groups, what is to become of the twofold subdivision, admitted, I think, a little too easily into clinical medicine? Does pathological anatomy furnish us with examples of nephritis affecting at the same time the epithelial parenchyma and the connective tissue? Assuredly. In the acute and subacute nephritis, caused by cantharidine, we find,[1] along with epithelial lesions, exudation, hyaline casts, migration of leucocytes, and alterations in the connective tissue.

In experiments on lead poisoning, made by causing guinea-pigs to live in an atmosphere containing carbonate of lead, and mixing these substances with the bran which formed part of their food, we obtained an intense interstitial nephritis, which was preceded by parenchymatous nephritis. In this form of lead poisoning, as appears from the admirable researches of Charcot and Gombault,[2] the lead at first produces true infarcts in the tubes of Henle's loops by the passage of carbonate of lead into the epithelial cells, with desquamation and proliferation of these cells. All the lesions of granular kidney make their appearance consequently to these infarcts. We shall return to these experiments when we consider interstitial nephritis. With very few exceptions, however, lesions which are entirely localised to the parenchyma or to the connective tissue can be produced experimentally. For example, we see on the one hand in nephritis due to phosphorus poisoning, lesions which are exclusively epithelial, viz.—cloudy swelling of the cells, fatty granulations in large quantity in the protoplasm, exudation in the tubules, hyaline and granular fatty casts,—without interstitial lesions. On the other hand, in the nephritis that Gombault and Charcot[3] have produced by ligature of the ureter, the lesions are almost entirely interstitial.

[1] *Practitioner*, 1881, p. 112.

[2] *Archives de Physiologie*, 1881, p. 126.

[3] Strauss and Germont ("*Des Lesions histologiques du Rein consécutives à la Ligature de l'Uretère*," *Arch. de Physiologie*, 1882, t. ix. p. 385) have shown that the

We shall find also in man, and particularly in old people, coinciding with general atheroma, kidneys affected by chronic interstitial nephritis without albuminuria.

To sum up in general terms, we may say that in the majority of cases of nephritis the parenchyma and the connective tissue are simultaneously affected, but in different degrees.

II.

Scarlatinal Nephritis.

For a good while scarlatinal nephritis has been regarded as the type of interstitial nephritis. It forms an intermediate link between cases of transient nephritis and permanent nephritis; we must therefore carefully examine its pathological anatomy under both heads.

The nephritis which is observed at the end of the second or in the third week, or even a month, after the commencement of scarlatina, is the most intense of all the forms of transient albuminous nephritis. It may pass into the chronic condition and last for months, for a year, or even more. In these chronic conditions it may still terminate in cure. It is distinguished from the other forms of nephritis occurring in fevers by its being frequently accompanied by œdema more or less general, by uræmia, or by fibrinous or purulent inflammation of large serous cavities, so that the patients sometimes succumb to this combination of complications. It varies besides with the epidemic. Finally scarlatinal nephritis sometimes passes into the condition of permanent incurable nephritis. We shall find then in this form of disease very varied conditions of the kidney, and all the intermediate states between transient and permanent nephritis.

In studying the kidneys of scarlet fever we shall thus have occasion to pass in review the majority of lesions which occur in parenchymatous or diffuse nephritis.

results obtained by Charcot and Gombault are considerably modified by employing strict antiseptic precautions in ligaturing the ureter; although septic bacteria occurring from the method of operation employed by Charcot and Gombault appear to have had something to do with the results they obtained, the result itself, that is to say the production of interstitial nephritis, has been obtained notwithstanding.

Microscopic examination of the kidneys in the acute stage of scarlatinal nephritis has yielded the contradictory results which I am about to mention.

E. Wagner described in 1867[1] the kidneys of scarlatinal patients as hypertrophied, whitish or marbled with white patches, and exhibiting an infiltration of round cells in the glomeruli and in the periglomerular and intertubular connective tissue. These round cells resembled, more or less, white blood corpuscles. He gave to this lesion the name of acute lymphomatous nephritis. In three cases of this kind which he observed, the patients died rapidly, two of them with symptoms of uræmia. Similar observations have been made by J. Coats and Klebs, Kelsch and Charcot. In these cases there was an infiltration in some places of the periglomerular and intertubular connective tissue with round migratory cells. The Malpighian tufts appeared absolutely covered and filled with round cells, so that they were transformed into a mass of embryonic tissue. Lesions of this sort affecting the Malpighian glomeruli with such intensity are always extremely grave, for the glomeruli in which the transudation of the liquid materials of the urine chiefly occurs, can hardly perform their function any longer. One can perfectly understand that this obliteration of the glomeruli is almost equivalent to an arrest of the secretion of the urine, with all its consequences. In particular an accumulation takes place in the blood of the excrementitious materials which the renal filter allows to pass out in the normal condition; hence the symptoms of uræmia. These lesions have attracted the attention of observers, and Kelsch and Charcot have regarded the kidney of scarlatinal patients as the type of acute interstitial nephritis.

But it is necessary to examine still more exactly the position of the cells in the Malpighian glomeruli and to determine whether the accumulation of cells is situated in the empty space which exists between the vascular tuft and the capsule of the glomeruli, or in the vascular tuft itself, either in the capillary vessels or between the vascular loops. If the cells of the new formation are in the space between the capsule and the loops we must ascertain whether they adhere to the surface of the

[1] *Archiv der Heilkunde*, vol.. viii. p. 262.

vascular loops, or if they come from proliferation of the epithelial cells of Bowman's capsule.

If we examine with care the lesions of the glomeruli in scarlet fever, we see that migratory cells are very rarely to be found between the vascular loops in what is usually considered to be the connective tissue of the glomeruli, but that they are usually found between the glomerular tufts and Bowman's capsule. We believe that in the observations already mentioned the principal thing is the diapedesis of leucocytes which accumulate in the glomerular cavity between the vascular tuft and the capsule, while at the same time the epithelial cells of the capsule become swollen and desquamate, the flat cells which cover the free surface of the capillary loops also taking part in the inflammation.

Let us now compare the sum total of these anatomical lesions with those which I have described in detail as occurring in acute poisoning by cantharidine. We see then that in the nephritis of scarlet fever, typhoid fever, or of diphtheria, the glomeruli are injured and that diapedesis of red and white corpuscles occurs in them as well as in poisoning by cantharidine. But it must be noted that in them the inflammation of the glomeruli is far from presenting the same degree of acuteness.

Besides, the glomerulitis only constitutes a part of the renal alterations in scarlatinal nephritis. This is evident from observations published several years ago. Litten has published some in which the connective tissue was normal, and the epithelium of the tubules alone was affected with granular fatty degeneration. E. Wagner[1] also classes the majority of cases of scarlatinal nephritis as acute diffused nephritis or large white kidney, in which all the lesions have their seat in the epithelium. According to the majority of authors, and according to our own personal researches, the renal parenchyma always presents all those lesions of the cells and of the contents of the uriniferous tubules which we have already studied in transient nephritis, and to which it is unnecessary to return. If we were to restrict ourselves to certain published facts, we should be led to distinguish in scarlatinal nephritis two varieties: one charac-

[1] *Beiträge zur Kenntniss des acuten Morbus Brightii*, p. 544; *Deutsches Archiv f. klinische Medicin*, vol. xxv.

terised by glomerulitis and acute interstitial nephritis, the other by diffuse or parenchymatous nephritis. But we shall avoid this subdivision for the simple reason that scarlatinal nephritis produced by an unequivocal cause is always characterised by lesions affecting both the epithelium and the contents of the tubules. In very intense cases there is very marked inflammation of the glomerular apparatus, with diapedesis of cells into the cavity of the glomeruli and into the periglomerular connective tissue. This is not surprising, since we have demonstrated the same thing in the acute and subacute albuminous nephritis of cantharidine poisoning, and since the study of various forms of transient nephritis shows us that some glomerulitis is present in them, though certainly much less than in certain forms of scarlatinal nephritis. This combination of inflammation of the glomeruli with typical diffuse parenchymatous nephritis appears still more clearly in the description of permanent albuminous nephritis we are about to give.

To sum up, can scarlatinal nephritis be considered as a pure interstitial nephritis? The whole kidney is altered; the glomeruli are inflamed, and sometimes to a very great extent, but the epithelial parenchyma is so also. In all cases the epithelium of the contorted tubules is cloudy, granular, swollen, and the lumen of the tubules contains exudation, casts, &c. The epithelial cells are often in a state of fatty granular degeneration. Scarlatinal nephritis is then a transient nephritis, but of great intensity, which may pass into a chronic condition and then assume all the characters of parenchymatous nephritis (large white kidney).

III.

Forms of Permanent Parenchymatous Nephritis.

Acute Permanent Nephritis.—We shall now consider permanent nephritis accompanied by dropsy, that is to say, true Bright's disease. There are many varieties of it. We shall first of all examine *acute* permanent nephritis, which has a duration of from several weeks to two or three months, and which results from varying causes, amongst others cold and alcoholism. In

this acute form the kidney is congested; the stellæ of Verhegen are dilated, and very evident on the surface of the kidney; the volume of the organ is normal or slightly hypertrophied. On section we do not find the dull white look which characterises the white kidney though sometimes the surface of the kidney is marbled with white, or the cortical substance may present on section a yellowish red colour. In many cases lesions can only be shown to exist in the kidney by microscopical examination. The results of this examination are as follows:—

The *glomeruli* are often altered in one or other of their constituent parts. The inflammation of them which we are just going to describe has received the name of *glomerulitis.* The lesions affect the epithelial covering of the capsule, the superficial cells of the vascular loops, Bowman's membrane and the walls of the blood-vessels. The flat epithelium which covers the internal surface of the capsule usually exhibits a very marked proliferation, and we then find a row of polyhedral or spheroidal cells, which are thicker than in the normal condition, and projecting. They are frequently detached, or adhere to the capsule by one extremity only, or occur in several layers adhering to the capsule. They are polyhedral on account of their mutual pressure. Sometimes these cells form a single mass in the capsule opposite the mouth of the contorted tubule which passes from it.

Very often analogous lesions are to be observed at the same time, originating in the stratum covering the free surface of the glomerular loops, and which is very thin in the normal condition. The nuclei in this layer proliferate, project, and become surrounded by granular protoplasm and individualised as distinct cells. These cells form a distinct projection on the surface of the loops; seen in profile, they present the form of a crescent or of a cap at the extremity of the glomerular loops, and they detach themselves at a certain stage. They have been well figured by Langhans. From their variable forms they have got the name of foot-shaped, club-shaped, sling-shaped, or clapper-shaped. After adhering for a certain time to the surface of the capillaries of the glomeruli, they fall into the glomerular cavity and are at the same time replaced by other cells. The result of this is an accumulation in the

glomerular cavity of flat, or polyhedral, or spheroidal cells, very irregular and often adherent to the vascular tuft. An analogous proliferation, but less intense, occurs between the vessels which compose the glomerulus at the same time that the walls of these vessels become thicker and their lumen is narrowed.

It is easy to perceive the importance of recognising these lesions, and their consequences are very grave. If the majority of the glomeruli are inflamed in this way, the conditions of the urinary secretion become completely modified. The water excreted from the blood passes chiefly through the glomerulus, and the vessels having become but little permeable, the quantity of urine secreted diminishes very markedly, and symptoms of uræmia may result.

In consequence of the inflammation of Bowman's capsule bundles of connective tissue sometimes form on the inner surface of this membrane. Thus in Brault's observation a great quantity of round or irregular cells, with large nuclei, and separated by threads of fibrous connective tissue, were adherent to the internal surface of Bowman's capsule. From this a network resulted, the threads of which were united to Bowman's capsule and were formed of fibres of connective tissue. Its meshes were filled with cells either free or agglomerated to one another, or adherent to the fibrous bundles. This is the most marked type of chronic inflammation of the glomerular capsule.

The most advanced degree of subacute or chronic inflammation of the glomerular tuft consists in its fibrous atrophy, which transforms it into a nodule of fibrous tissue impermeable to the blood.

These lesions of the glomeruli, even when they are acute, react almost constantly on the renal connective tissue, on the parts surrounding the capsules ot the glomeruli, and on the external sheath of the vessels, arterioles, and venules at the hilum of the vascular tuft. The wall of the capsule itself is also notably thickened.

These are the lesions distinctive of glomerulitis, which is an important factor in permanent albuminous nephritis, but also, though to a variable extent, in diphtherial and scarlatinal nephritis.

The contorted uriniferous tubules in kidneys affected by permanent nephritis, present lesions which we have already studied several times, and which we will not return to here: viz. exudation, casts, &c. An interesting alteration in the cells consists in the vesicular or vacuolated state which I have already described. The cells present in their interior vesicles or vacuoles, which are found at the side next the lumen of the tubules. This alteration leads to the formation of spherules which detach themselves from the cells and fall into the interior of the tubules. The lumen of the tubules contains at the same time leucocytes or extravasated red blood corpuscles.

The *epithelial cells* of the straight tubes are little altered. One finds, however, in the lumen of the tubules the exudation which forms the hyaline casts which occur in the urinary sediment. When we examine the sediment after the action of osmic acid they are found in the form of cylinders of a brown colour, sometimes rolled together like a corkscrew with a diameter equal at different points, and presenting sometimes transparent apertures and transverse fissures. The corkscrew form no doubt results from the casts being elongated in the tubes of Henle, and rolling round when they arrive at the wider part of the tubule. When there is intense congestion and hæmorrhage into the interior of the tubules, we find in the urinary deposits, along with hyaline casts, fibrous casts characterised by the presence of fibrin, which swells up under the influence of acetic acid, and contains in its interior red and white corpuscles. We may sometimes find also casts composed of a granular mass containing fatty molecules; these are fatty cylinders. They are chiefly met with in poisoning by phosphorus.

We must now ask what is the relation between the fatty degeneration of the cells and the alteration of the glomeruli which we have just described? It is very probable that the fatty degeneration is consecutive to the modifications of the circulation, and is due to the anæmia which results from the chronic inflammation, and from the contraction of the lumen of the afferent vessels and of the glomerular loops. Nevertheless it often happens that the epithelial cells of the tubule exhibit no fatty degeneration when the glomeruli are affected by very intense subacute inflammation.

In such an acute and intense form of permanent nephritis as we are now considering, the granulo-fatty degeneration of the epithelial cells of the kidney is generally absent. It only commences to appear when the disease has lasted for a long time. When the nephritis is subacute, it is less marked and generally partial. The best method of demonstrating granulo-fatty degeneration consists in treating sections of the fresh kidney with formic or acetic acid. When such sections are examined with a magnifying power of forty diameters, a greater or less number of the uriniferous tubules are to be seen, of a dark colour and completely opaque. With a higher power we can see that the opacity is due to a quantity of small, fatty granules in the epithelial cells of the tubule. These preparations are best stained and preserved by osmic acid, which blackens and fixes the fatty granules.

The various lesions, which we have just considered in the acute form, may be combined in very different ways, and thus constitute many varieties, into the particulars of which we cannot enter.

(To be continued.)

TRANSPLANTATION OF CONJUNCTIVA FROM THE RABBIT TO THE HUMAN SUBJECT.

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In a notice of my work on "Diseases and Injuries of the Eye," which appeared in the *Practitioner* [xxviii., 441], the reviewer expressed a desire for more information as to the transplantation of conjunctiva from the rabbit, to which the attention of the profession had been drawn by the cases exhibited by me at the annual meeting of the British Medical Association in Edinburgh in 1875. I cannot help complying with the desire thus expressed, by giving a short record of successful cases of this operation and presenting it in its new phases, along with other original contributions to ophthalmology.

Of all the various injuries of the eye, burns of the conjunctiva have been considered the most tantalising and unsatisfactory to deal with. When the whole cornea has been rendered opaque, the case is hopeless, and there is an end to all surgical interference. But in cases in which the cornea has escaped, or is only partially implicated in the injury, and the burn is principally confined to the conjunctival sac, there is adhesion of the lid to the eyeball (symblepharon), and we have a difficult problem to solve. The condition of things is as follows: The lower lid, generally, and sometimes also the upper, is adherent to the eyeball, which is covered and rendered immovable. Immobility of the globe and inability to raise the lid takes place even when the conjunctiva of the upper lid is not implicated in the burn.

Here, then, we have an eye, which is otherwise useful or capable of being rendered tolerably so, but which is tied down —buried, as it were—under an adherent lid, and rendered immovable. All the contrivances resorted to by surgeons to separate the lids from the globe have proved a mere waste of ingenuity—have, in other words, ended in disappointment. Impelled by a feeling of perplexity, and a conviction that something might be done to save such eyes—to bring them to the light of day, and restore their mobility—I tried to fill up the lacuna by conjunctiva from the rabbit.

The result of my first operation was submitted to the Glasgow Medico-Chirurgical Society in December 1872, and at the meeting of the British Medical Association held in Edinburgh in August 1875, I exhibited two cases. One was that of a boy aged nine, who had had his right eye burnt with lime. The whole conjunctiva and also the greater part of the cornea was implicated. Having first made an artificial pupil, and thus restored some measure of sight to the eye, I then operated for the cure of symblepharon by transplantation. The patient was exhibited ten days after the operation, when some of the ligatures still remained in the conjunctiva. It could thus be seen that some portions of the transplanted membrane had assumed a pinkish appearance, while other spots had still a greyish look. This was a case particularly favourable for demonstration. Fig. 1 shows the extent of the injuries done by the burn to the conjunctiva and cornea, and the sight and mobility restored by the operation. It shows also the position of the ligatures in the transplanted membrane.

The second case which I exhibited at the meeting was that of Peter Campbell, quarryman, then aged twenty-two, who had received an injury in his face and eyes from an explosion of gunpowder in January 1872. His whole face was riddled by the powder. His left eye was completely closed by symblepharon and the greater part of its cornea burned. Both the upper and lower lids of the right eye were completely everted and adherent and the cornea ulcerated by exposure. In the left eye I made an iridectomy upwards, which resulted in tolerably good sight when the upper lid was raised, as seen in Fig. 2.

In January 1873 I remedied the symblepharon by transplantation from the rabbit. This case was a remarkable one, and I shall return to it presently in connexion with the formation of the lids of the right eye.

This method of conjunctival transplantation has been practised successfully by such eminent surgeons as Professors von Weckar, Paris, Otto Becker, Heidelberg, Albrecht Graefe of Halle, and others, and I have been in the habit of resorting to it whenever I wished to supply a deficiency of conjunctiva.

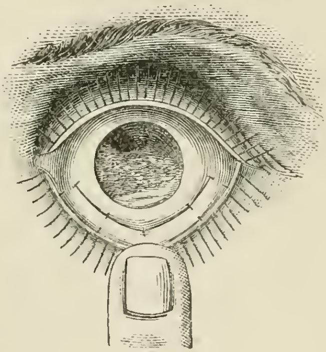

Fig. 1.

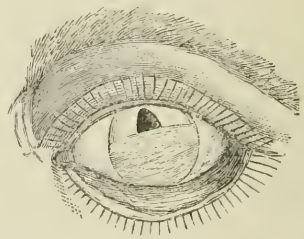

Fig. 2.

In July 1883 I had a case which I had intended to exhibit at the meeting of the British Medical Association in Liverpool. To my great regret I was unable to attend that meeting. The following notes of the case were taken by my assistant, Dr. Thomson :—

"Symblepharon and ankyloblepharon (total) cured by transplantation from the rabbit :

"Jeremiah Jones, steel worker, aged twenty-two, got his left eye burned by a flash of slag from the forge hammer nine years ago. He was under treatment at Workington for four months, after which he was sent to the Manchester Eye Infirmary. Here (he states) attempts were made to keep the eyelids apart by means of strings and lead and a ring round his nose. When he came to the Glasgow Ophthalmic Institution, on March 17, 1883, the eyelids were completely closed, the free borders of the lids were obliterated, so that the dissection of the upper and lower lids from the globe was effected with great difficulty.

'Buried under the lids' is an exact description of the state of the eye in this case. When the lids had been dissected, we found that only the upper and outer quadrant of the cornea was transparent—the rest was quite opaque. By means of ligatures inserted into them the lids were kept separate, and an artificial pupil was formed in front of the transparent cornea. The symblepharon was subsequently remedied by transplanting conjunctiva from the rabbit. The conjunctival sac is now free through its whole extent, except at the inner angle, where there is a slight adhesion. The eye is movable in every direction, vision is restored, so that the patient can see the time on a watch-dial distinctly."

In my two last cases the operation has been performed as follows:—The patient is put under chloroform, and also, at the same time, two rabbits; one being kept in reserve in case of accident. In this connexion I may mention that I find the grey wild rabbit more suitable than either the white or black; the conjunctiva in it is tougher and stronger and stands handling better. Dr. Noyes of New York also recommends black instead of white rabbits. I then separate the adhesions, so that the eyeballs can move in every direction. I then if necessary enlarge the external palpebral opening of the rabbit so as to enable me to evert the lid better for dissection. Ligatures are then introduced into the conjunctiva of the rabbit to mark the extent of the membrane to be removed; by means of the ligatures it is put on the stretch and dissected with strabismus scissors. The membrane is spread out on the back of my hand and left to dry there while I finish the preparation of the part for its reception. The flap is cleaned and trimmed, after which it is slightly moistened and then removed to its new site. It is now at once stitched to the fore border of the lid which is at the same time strongly everted, spread out carefully, and secured at the *cul-de-sac*. I generally find eight ligatures sufficient to keep the transplanted membrane in its place. The ligatures are left in for four or five days before they are removed.

For the last contribution to the literature of the subject I am indebted to Dr. Noyes of New York, who has in some particulars modified my method of proceeding and some of whose suggestions merit consideration. He reports that, soon

after the operation was announced by me, he made trial of it, and that he was on more than one occasion aided by Dr. Little, who was then (1873-4) his assistant in the New York Eye and Ear Infirmary, and who has recently published a case of his own. In describing his operation Dr. Noyes says—"When it [the flap] has been separated, I put it into a saucer of tepid water and fasten it on a submerged piece of cork by the points of threaded needles. I now trim it to proper shape; next I carry it on the cork to the eye, and run two of the threads from the piece into their places in the patient's eye. Then, taking out the needles from the cork, draw their threads from the piece and pull it into its place and lay it out smoothly. I apply it to the eyeball, and cover as much of the lid and globe as possible. To make the *cul-de-sac*, the stitches are brought through the eyelid and tied over a bit of stick on its outer surface. As many as ten stitches or more may be required to hold the piece in place." [1]

Among American surgeons Dr. Noyes first applied this operation to the formation of the sac for the purpose of fitting in an artificial eye when the natural cavity has become contracted, but Professor Cohn of Breslau had previously performed the operation for a similar purpose. Dr. Noyes immerses the conjunctival flap in salt water (1 per cent.) as he thinks that it protects the epithelium of the conjunctiva.

Dr. Noyes's cases now number about a dozen, and he reports that, "in no instance have I met with an entire failure, while the degree of benefit has been various."

During the last eleven years I have operated in thirty-five cases by this method, and my own experience is that the operation proves highly satisfactory, considering the character of the cases we have to deal with. But I attach great importance to putting the flap down in such a way that there is no curling up or twisting, and so that no mistake can be made as to which is the epithelial surface.

There is one question, and that a most essential one, as to the durability of the operation. It is satisfactory to make a conjunctival sac, but how long will it last? Do the surfaces by constant friction tend to adhere? I have just now (Nov. 30,

[1] *New York Medical Record*, March 3, 1883.

1883) come across one of the patients whom I exhibited at the Edinburgh meeting mentioned above, and could not resist the temptation of having his photograph taken.

Fig. 3.

In his case the conjunctival sac is still as perfect as it was eleven years ago. Both eyes are perfectly good. He has been all the time working at the quarries. The upper and lower lids of the right eye which we had corrected by skin flap from the arm are good and serviceable. It will be seen that in the lower lid the skin, which we had transplanted from the arm, is not only intact, but bears a row of hairs at the border representing the lashes—somewhat abundant, and out of shape to be sure, but still there they are. There was no hair on his forearm when we removed the skin from it (he was then a young man of twenty-two), but now it has grown. The vitality of the transplanted skin flaps is thus demonstrated.

NOTES ON RATIONAL HYDRO-THERAPEUTICS.

BY GEORGE LUCAS PARDINGTON, M.D.

HYDROTHERAPY is a time-honoured subject. Many references are made by Celsus (*circa* B.C. 18) to the various uses of water in the treatment of disease. Writings on that subject have been fairly abundant; but the majority of them refer to its employment in the treatment of acute diseases, notably fevers.

The use of water as a therapeutic agent in the treatment of chronic disorders did not receive much attention till it was brought forward and urged upon the world by the Austrian peasant, Priessnitz, in 1830. He, being an ignorant man, took up the subject in a perfectly empirical manner, and shrouded in empiricism it has been more or less ever since. Priessnitz created for himself an extensive reputation, and the so-called "hydropathists" have traded upon his system since that time, connecting with it a certain amount of mystery, and endeavouring to estrange from it any scientific element.

The subject is now treated much in the same way to a large extent. The "hydropath" declares that he uses nothing but the most simple agents in his treatment; but when employed under the strict routine of his system it works in a very mysterious manner. The persons who chiefly avail themselves of this kind of advice are for the most part of the lower middle classes, also hypochondriacs of all stations in life. The mysteries which are supposed to attach to this "system" (as it is called) endear it greatly to their minds, and they sometimes become almost fanatical. Their adviser points out to them that there is nothing done that they cannot understand; he stigmatises the treatment of scientific men as behind the age, irrational,

and positively injurious; he informs them that all drugs act as cumulative poisons; and I have met with many patients who have been assured that the discharge from the pustular eruption —which follows the continued application of water to the skin —was nothing more or less than the elimination of effete matters from the blood, and that amongst other constituents it contained the "poison" of all the medicines they had taken in former years.

The great success which attends some of this treatment is undoubtedly due to the altered surroundings of life which the patients have to undergo at most of the establishments where it is carried on:—the regular living; food of a plain wholesome character; the avoidance of late meals; the temporary abstinence from all stimulants; regular hours for rising and retiring to rest, together with certain forms of amusement which are usually provided, and which tend to divert the attention of the invalid from his abnormal condition.

Now in hydrotherapy we have most valuable and potent adjuncts to medical treatment: but it is *as* adjuncts that these means should be employed, and their use should be promoted on a sound physiological basis, and not upheld as a universal panacea in opposition to all other forms of scientific treatment. The subject, rational hydro-therapeutics, comprises the scientific application of water as a simple agent in the treatment of disease. Water may be used either hot or cold; internally or externally; the forms of external application being very numerous.

The *internal* use of water as a therapeutic agent is rather limited. Its chief effects are: to increase the metabolism of the body generally—augmenting the secretion, and having a lixiviating effect upon the tissues; to act as a diluent of the blood, and so assist in the solution and excretion of certain effete materials; to stimulate the gastro-intestinal tract.

A course of drinking cold water plentifully between meals has a very good effect on patients who lead a sedentary life, and whose secretions are scanty and defective; the secretions become re-established, and effete matters are carried away from the circulation; the tissue metamorphosis also is rendered more complete.

The free use of cold water is of especial use in gouty subjects; the blood is diluted, the quantity of urine increased, and the excess of uric acid is rendered more easy of removal.

The action of cold water on the stomach is that of a stimulant —provided always it be taken in moderate quantities—the cold acting on the peripheral terminations of the afferent fibres of the vagus as a stimulus, causing an increase in the flow of gastric juice, and fitting the stomach for the reception of food; the movements of the stomach are also increased, and so the digestive powers enhanced. If the quantity of water taken be too large, the stomach is distended, its movements impeded, the gastric juice diluted, and digestion much impeded.

A tumbler of cold water taken on an empty stomach on rising rapidly stimulates the peristalsis of the intestinal tract, thereby assisting in the onward passage of fæces; this well-known remedy is an excellent one in cases of habitual constipation.

The *external* use of water—baths and applications.

The susceptibilities of individuals vary greatly with regard to temperature, and hot and cold are only relative terms expressive of different degrees of this condition. Hot is generally taken to mean a temperature of 98° F. and above; cold, 60° F. and below, and between these two there is an intermediate temperature, usually known as tepid, and partaking slightly of the effects of cold and heat.

Cold.—The primary effect of cold applied to the surface of the body, as in the cold bath, is to cause a general fall in the temperature of the skin, and at the same time a rise in the temperature of the blood. This rise is only very temporary, the temperature of the blood rapidly approximating that of the skin. The *respirations* are at first quickened, and the amount of carbonic acid exhaled is increased; afterwards respiration becomes slower and deeper. The *pulse* is correspondingly at first quickened and afterwards slowed. The *sensibility of the skin* is increased at first; but if cold be long continued it is very much diminished. There is temporary congestion of internal organs, causing activity in function, and increased tissue metamorphosis.

Cold acting on the periphery of the sensory nerves in the skin is a great stimulus to the central nervous system, as

evidenced by the gasping respiration, increased cardiac action, &c. If cold be long continued a feeling of numbness or partial anæsthesia succeeds the heightened sensibility which is at first induced, and if the reduction in temperature be pushed to extreme limits complete anæsthesia is produced; this fact has been made use of in the freezing of the skin by ether spray in minor surgical operations. Sensation gradually returns as warmth is restored.

If after a short time the bath be suspended, the condition known as reaction occurs. This reaction is the expression of a physiological resistance to the effects which are primarily induced by the action of cold. The circulation through the skin commences with renewed vigour; the feeling of cold is succeeded by that of warmth and general exhilaration, and this is especially the case as long as the increased heat production lasts. Now if the application of cold be continued long after this stimulating effect is apparent, another condition of things is brought about, viz., refrigeration. During the bath or application there is a constant conduction of heat away from the surface of the body, and if it be continued beyond a certain point the refrigeration proceeds in a much more rapid way. Thus there are two great effects of the application of cold:—*a*. Stimulation of the skin, nervous system, and functions of the body generally—the tonic effects. *β*. General refrigeration, which is the effect desired in hyperpyrexia—the depressant effect.

Warmth.—In the hot bath all the parts where the direct effects of warmth are felt are relaxed. The vessels of the skin are dilated, then after a while contracted, so that the rapidity of the circulation through them is increased. The hot bath increases the heat of the body both by diminishing the heat-loss which normally occurs by evaporation and radiation, and—if the bath be of sufficient temperature—by directly supplying heat to the parts with which it is in contact.

Warmth acts by directly promoting functional activity, as opposed to cold, which produces an increase in function by reflex stimulation. In persons of a robust nature cold acts beneficially by calling forth the latent power of reaction in the system, whereas in enfeebled or debilitated subjects, whose power of reaction is very limited, or in those who have become temporarily

enervated by violent exercise, the warm bath brings about a similarly refreshing and invigorating effect, without making additional calls on the strength of the already weakened system. Warm baths facilitate function by the direct supply of heat, and also by the stimulus which they afford to the central nervous system. The very hot bath, *i.e.* above 105° F., acts as a very powerful stimulant to the nervous system, and its use should be very restricted.

All baths, applications, &c., should be taken, as far as possible, at a time when the stomach is not engaged in digestion, *i.e.*, some considerable period should be allowed to elapse after a meal before any treatment is entered upon.

The cold bath is not admissible under certain conditions, viz. a feebleness of the circulation from whatever cause, preventing a proper reaction; asthma, as a rule; advanced pulmonary emphysema; anæmia; advanced renal disease; diseases of the blood-vessels, tending to weaken their walls.

The different effects of baths, &c., are determined by the following considerations—form of administration; temperature, duration, condition of the water, *i.e.*, either still or moving.

The following is a simple classification of external hydro-therapeutic measures:—

Baths.—1. General.

- *a.* In which the water is still:—the long bath, the vapour bath, the steam bath, the electric bath.
- *β.* In which the water is in motion:—rain bath, wave bath, spray bath, shower bath.

2. Local.

- *a.* In which the water is still:—sitz bath, foot bath.
- *β.* In which the water is in motion:—running sitz bath, the various forms of douches.

Applications.—1. General.

Wet sheet with friction, wet sheet packing.

2. Local.

Packing to various parts:—spine, loins, chest, abdomen, liver, limbs, joints.

Compresses:—throat, abdomen, chest.

The Long Bath.—This is the ordinary bath, five to six feet in length, in which the whole body, with the exception of the head,

is entirely immersed in water. The head should, however, always be wetted before entering the bath. Here the water is motionless; so when used cold this form can be borne by persons to whom the shock of cold water in a state of agitation would be too severe. It is used chiefly as an ordinary tonic cold water bath; as a hot bath when it is desirable to produce slight revulsion to the skin, in cases of rheumatic pains, in diseases of the genito-urinary tract for the relief of spasm and pain.

In acute disease the long bath has been chiefly employed as an active therapeutic measure in cases of hyperpyrexia. It was used largely by Brand (1861), and subsequently by Glénard (1874). There are several methods of application in these cases. The patient is either immersed in quite cold water at once, or the bath is gradually cooled down from 90° F. to 60° F. The latter form of administration is probably the better, as it is productive of less shock to the patient; it has quite as great a refrigerating effect, and there is a less speedy subsequent rise of temperature.

The Turkish Bath represents the general form of hot-air bath now used. It is too well known to need much description; but the essentials are a series of heated chambers of differing temperatures, a room for the shampooing process, and a room for resting and cooling down at the completion of the bath.

The cooling room should be of an equable temperature, about 60° F., *perfectly* free from draught, and should be provided with good reclining couches. The shampooing room should be kept at a temperature of about 70°—80°, and in it should be a rain or spray bath for cooling down the skin after the shampooing. It is usual to have a cold plunge bath in connexion with this room, but for any except the most robust a well graduated rain bath is much to be preferred. The hot chambers should be perfectly ventilated, and the air in them thoroughly dry; the first should be kept at a temperature from 130°—140°, and the second from 150°—170°. These are all the rooms that are necessary for practical purposes, and they should be provided with wooden benches for reclining upon.

The bather should undress in the cooling room, put a towel round the loins, and thoroughly wet the head with cold water, and fasten a cold wet towel round it; he should then pass

at once into the hotter room of the two, and quietly recline on one of the benches. At first the pulse and respiration are increased in rapidity and force: then the cutaneous vessels are dilated, and the skin after a variable time breaks out into a copious perspiration. Cold or even iced water should be taken freely by the bather during his stay in the heated chambers. After remaining in the second or hotter room for five or ten minutes, according to the susceptibility of the skin to act, the bather should go into the first room, and there remain from ten to thirty minutes according to circumstances; during this time he continues to perspire freely although in a lower temperature, the action of the skin having been thoroughly established by the high temperature of the hotter room. He now proceeds to the shampooing room, when a certain amount of shampooing is administered by the attendant, accompanied by hot soaping. The manipulation should vary according to the requirements of each individual case. In cases of stiffened joints massage may here be most advantageously employed to the affected part. In general shampooing, the skin is thoroughly cleansed of effete matter, its excretory functions established, and the muscles are rid of the products of an imperfect metabolism. After this the process of cooling is to be gone through. This is best accomplished by some simple form of cold affusion, such as a rain bath; the bath should commence at a temperature of about 80° F. and then be gradually reduced to 60° F. or 55° F. This is better than sudden cooling, as it causes no shock to the nervous system, and the subsequent secondary perspiration is less, as the cooling is gradually brought about. The patient is then wrapped in a large Turkish sheet, and should proceed at once to the cooling room, and lie down for at least half an hour before attempting to dress himself. The toilet should be performed very slowly, and no effort should be used in drying as it re-excites the action of the skin, which at this time it is highly desirable to prevent. It cannot be too strongly insisted upon that sufficient time be given to resting after the completion of the bath, in order that the skin may regain its normal tone, as all the colds which are attributed to the Turkish bath are traceable to a neglect of this precaution.

Vapour Baths are represented by the Russian, or Roman-

Irish baths, the only difference being the mode of production of the steam. Vapour baths differ from hot-air baths in the fact that evaporation from the skin and lungs is prevented, as the surrounding medium is saturated with moisture, and consequently they cannot be borne at nearly so high a temperature. The general effects of heat are the same in each. In the vapour bath drops of condensed vapour are deposited on the skin and respiratory mucous membrane, both of which are cooler than the surrounding medium ; in the latter situation these condensed particles cause a certain amount of expectoration. In construction these baths much resemble the Turkish bath, but the heated chambers are filled with steam, and kept at a temperature the first room, 110°—115° F., and the second 120°—125° F.; the wooden benches for reclining are placed at different levels, the higher ones being the hotter. There is a much greater sense of oppression felt in the vapour than in the hot-air bath, and general depression is much more readily induced. In the Friedrichs Bath at Baden-Baden the vapour and Turkish baths are adjoining, and the extreme sense of relief experienced on passing from the former into the latter is most marked, although one passes into a much higher temperature : the breathing becomes quite easy, and the sense of oppression at once disappears.

The mode of taking the two baths is very similar, but in the vapour bath it is not desirable to drink any cold water during its continuance. These baths act much in the same way on the animal economy, and I have found most benefit from them under the following conditions :—Given of short duration, and properly taken so that no fatigue is induced, they act as powerful alteratives and tonics, sometimes effecting a great change in chronic maladies connected with the various forms of hysteria ; the weight of patient is invariably increased by a course of baths of short duration ; the imperfect metabolism is rendered more complete, and the tissues are renewed ; waste products, and effete matter being removed, a healthy action of the sluggish skin is induced, and other baths, before unbearable, can now be undertaken. Catarrh in the early stage is much benefited ; chronic rheumatism in its various forms, as local manipulations can be most advantageously employed after the general

relaxation of the tissues produced by the heat; in neuralgia, and sciatica, especially of rheumatic origin; in chronic nasal and pharyngeal catarrh. In many functional nervous disorders, characterised by irritability, a very soothing effect is obtained, and insomnia relieved. Carefully employed Turkish baths in some cases of anasarca with renal disease bring into play the full action of the skin as an eliminating organ, to get rid of the fluid in the tissues. These baths are contraindicated in advanced emphysema, diseases of the blood-vessels, and grave organic disease of the heart, lungs, and kidneys.

The Electric Bath.—This is merely an ordinary long bath at 98°—100° F., in which the patient sits whilst the electricity is administered to him. It is simply a convenient form of applying electricity. A broad plate connected with the positive pole of the battery is placed at the end of the bath, against which the spine of the patient rests; a foot plate connected with the negative pole against which the soles of the feet are placed, at the foot of the bath. Either the galvanic or Faradic current can in this way be applied through the lower extremities. I have found good service from this method of employing the constant current in sciatica, hæmasthenic pain, and in the lightning pains of locomotor ataxia. The bath should last from twenty to thirty minutes.

Rain, Wave, Spray, and Shower Baths.—In all these baths water is projected over the surface of the body generally, but in a different manner in each. In the two former the bather stands in a cylindrical box about six feet high, about one-sixth of the circumference of which is deficient so as to form an entrance to the cylinder. From the inner side water plays upon the surface of the body. Before entering the bath the bather should stand upon a warm pad, and wet the head with cold water. In the wave bath the water is projected in the form of waves or broad jets at different heights, the chief ones being about the level of the upper ribs. In the rain bath the water is thrown out from a system of parallel pipes perforated with very small holes in the form of rain drops. In the spray bath the patient should stand on a warm pad, and the water is projected over him from a large rose. In the shower bath the large rose is situated at a variable height from the floor, and the patient stands underneath it.

In all these baths the force with which the water impinges on the skin determines to a large extent their stimulating and tonic effect. Care must be taken that the bath be not continued too long, and that the temperature of the water be not too low, if the patient have a feebly reactive power, as the cooling effect is very rapid after a certain point; the fresh particles of cold water convey away a great deal of heat, and so reaction will be very slow in making its appearance, and the patient will be depressed instead of stimulated.

The best time for the administration of these baths is before breakfast, if the patient be strong enough (and they can be graduated to suit persons who can bathe at all). It is usually to be preferred that the bath shall commence at a temperature of about 90° F. and then after a short time be rapidly reduced to 60° F. or even lower if desired; in this way the shock attending the sudden application of cold is avoided; but in persons of a robust nature, and of good reactive power, the entirely cold bath has a more stimulating effect. When administered in the usual way the duration should be about three minutes hot, and five or six minutes cold; when given quite cold the duration should be shorter.

The shower bath is not much employed as a general bath, but more as a descending douche, under which heading it will be referred to subsequently. The wave, rain, and spray baths are chiefly employed as a general tonic measure; the regular use of them daily produces very good results in chronic constitutional affections—general debility, hypochondriasis, &c., and the rain bath forms the best kind of ordinary bath for healthy persons. The impact of the water in these forms causes a very large number of distinct stimuli to the peripheral nerve terminations; all these culminate in a strong afferent impulse, which, acting on the central nervous system, gives rise to a powerful reflex action. This is manifested by the general effects of cold bathing in a high degree—increase in functional activity: freedom from cold: good action of the skin: general exhilaration: increased appetite, &c.

A great many persons who are chronic invalids neglect to bathe regularly, and if they do bathe, it is done in an imperfect manner. I have been astonished many times at the good results I have seen

from insisting on the properly regulated daily use of the rain bath; in many cases especially amongst those patients who had neglected bathing from some imaginary cause or other.

Baths are constructed for the administration of hot air, or vapour, in such a way that the head is excluded. The bath consists of a large box provided inside with a perforated seat, on which the bather sits. The lid of the box has a large hole in the centre through which the head passes, so that the whole body is inclosed with the exception of the head. A small blanket should be placed round the neck, to prevent the escape of steam from the interior of the bath. The hot air is supplied by means of lamps underneath the seat; the vapour by small jets of steam in the floor of the bath, which can be regulated either from the outside or by a handle which the bather can turn himself. Patients should drink cold water, and have the head thoroughly wetted in this form of baths. These local hot-air and vapour baths are especially useful in cases when from some reason or other the general Turkish or Russian bath is inadmissible, and when it is desirable to bring about a similar effect. The duration should be from five to fifteen minutes. After it is over the patient should be sponged with tepid water, then with cold, and then wrapped in a large hot Turkish sheet for fifteen minutes before dressing.

Not infrequently the first application of these local steam baths causes a certain amount of depression in patients, so that they should be carefully administered, and the bath should be stopped if any symptom of faintness occurs. I have found this happen most frequently among ladies, and is, I think, due more to the feeling of helplessness at being shut in the bath, than any other cause; but the fact should be borne in mind.

Sitz Baths.—These baths are of great use in the treatment of pelvic disorders. They should be large enough for the patient to sit down comfortably in without cramping, and the water should come up nearly to the level of the umbilicus; during the bath the patient should be covered with a large blanket made for the purpose, with a hole large enough for the head to pass through near the middle of it. The cold sitz bath at first causes a determination of blood to the head, but afterwards, as reaction takes place, cerebral congestion is much relieved, and the flow through

the cerebral vessels is diminished, causing a drowsy feeling. A hot sitz bath has a somewhat similar effect, only that here there is a direct determination of blood to the lower part of the body. I have found the cold sitz bath very useful in cases of insomnia; especially in patients of a nervous temperament, or predisposed to be melancholic. A course of sitz baths increases the circulation through the pelvic organs, and promotes their greater functional activity.

In cases of dysmenorrhœa the warm sitz acts most beneficially given once or twice daily just before the flow; also in inflammatory diseases of the bladder and prostate; in gonorrhœa, stricture, and orchitis, it acts by relieving spasm, and producing a soothing effect generally. The use of the cold sitz bath requires to be extended over a longer period, as it is suited to chronic cases essentially. In pruritus ani et vulvæ it acts as a local sedative to the skin. In cases of chronic amenorrhœa it should be used in the interval between the periods, twice or three times daily. The reaction each time causes a temporary congestion of the pelvic organs, the uterus shares in this, and after a time is stimulated to resume its natural functions.

Foot Baths are used either to determine blood away from the head, or to increase the circulation through the lower extremities. A cold foot bath for ten minutes twice or three times daily, with thorough friction of the skin afterwards, is an excellent remedy for the habitual sufferers from cold feet. The domestic remedy of a hot foot bath is well known, but in this case it is used to induce general diaphoresis.

Douches are the most powerful means for applying water to the surface of the body. There are two forms: the water is either projected in a single stream, or else it is administered through a rose. The former is by far the most powerful, and its effect varies according to the size of the delivery pipe, and also with the strength of the current. Formerly very large douches were in use, one to two inches in diameter. When of this size, and used sometimes indiscriminately, they frequently did much harm, as the shock caused was very great. Douches have been, however, much decreased in size, and in most cases a stream a quarter of an inch in diameter is found to fulfil every purpose.

In the descending douche the stream is allowed to fall on the spine from a varying height in a vertical direction, the back being at first nearly upright in order to mitigate the first shock of impact; then the body is inclined slightly more to the horizontal position, and the stream allowed to fall upon the part of the spine desired.

The shower bath is really a descending douche of the rose variety, only in this case the stream impinges on the head, and covers the whole body.

In the horizontal douche the stream is directed from the douche pipe in a horizontal direction on to any part of the body it is desirable to affect. The ascending douche, usually of the rose variety, is administered to the anal region whilst the patient sits over it on a seat made like the seat of a water closet.

In vaginal douching the patient lies on the back with the knees raised, somewhat approximating to the lithotomy position, and the delivery pipe is inserted into the vaginal canal.

Douches are chiefly applied to the spine, spleen, liver, joints, anus, and vagina.

The spinal douche is usually of the single stream variety, and should be administered with fairly good force. It has a powerfully stimulating effect on the nervous system, and is of great use as a general tonic in cases of melancholia, cerebral anæmia, and in general debility when the system is strong enough to bear its employment. This form of douche is largely used by Professor Charcot in primary sclerosis of the cord. I have used it in such cases, but with little effect. The circulation through the nervous centres is increased by its application, and the patient braced up generally. It is better applied hot and cold alternately, unless some hot application, as a spinal pack, has preceded, then it may be administered quite cold.

The douche has been applied cold to cases of chronically enlarged spleen to reduce its size, and good results are said to have been obtained; I have employed it in cases of enlargement of the liver in the same way with marked benefit.

The douche is applied to stiffened joints with varying success, varying, of course, with the amount of change that has taken place in the joint itself. When the fibrous structures surround-

ing the articulation are stiffened from disease, &c., as after fracture, a great deal of good may be anticipated from its employment, coupled with other local measures.

The ascending douche is chiefly used in the rose form, and given cold it affords great relief in hæmorrhoids; also in pruritus ani it acts like the cold sitz bath, by allaying irritation and promoting a healthier action of the skin. In cases of constipation from atony of the lower bowel, the employment of the rose douche, at first tepid and then cold, at a regular hour daily, acts beneficially in inducing an action of the bowels.

The vaginal douche should be administered with fair force, and the patient should be resting in a fairly comfortable position on her back; the pipe should receive the supply from a cistern capable of receiving several gallons, which can be readily filled and kept at the same temperature, and fixed at a fair height from the patient, so that the stream shall have a certain amount of force. In cases of chronic subinvolution and hyperplasia of the uterus, the hot douche regularly used is of great service; it should be from 105° F. up to 110° if possible, and administered twice daily for several minutes each time. In cases of vaginal leucorrhœa and cervical catarrh a properly applied vaginal douche is of great service—in fact in any case where a simple injection is indicated, and also as a prelude to any medicated injection, as it cleanses the surfaces upon which the medicament is to act.

Enveloping the body with a *wet sheet.*—This proceeding is very useful sometimes, if the reactive power be small, to accustom the patient to the use of water. A large sheet, dripping with either tepid or cold water, is thrown over the patient, and the body vigorously rubbed outside the sheet by the bath attendant for two or three minutes; the patient is then gently sponged all over with cold water, and then dried with a warm Turkish towel. In this way reaction is very readily set up and a gentle stimulus afforded, which is a good prelude to further measures.

Wet packing.—This proceeding is as follows: a large sheet is wrung out of cold water and spread out on two or three blankets; underneath the whole is a large macintosh. The patient is laid on the sheet, which is rapidly rolled round him,

excluding only the head, the edge of the sheet being round the neck; the blankets are then wrapped round the sheet successively, and the macintosh over all in the same way, care being taken to tuck in well round the neck, and to perfectly include the feet. A cold wet cloth is then laid on the head, and a hot water tin to the feet, and another blanket thrown over the whole; the patient should sip cold water from time to time, and the cold cloth on the head should be renewed during the application, which should last about an hour. This is of the greatest use in hyperpyrexia and in insomnia, especially in the form accompanying alcoholism. The high temperature is reduced, the skin moist, and the pulse softer and more frequent. The patient when taken out of the pack is gently sponged all over with tepid water, dried, and put into bed again.

Local hot packs applied to various parts of the body.—These are really a very powerful form of fomentation. The hot pack consists of several folds of stout flannel, either stitched together to form a pad or simply folded. The pack is either heated in a steam chest or wrung out of hot water, and applied with a piece of macintosh sheeting the same shape, but a good deal larger, over it, and a blanket wrapped round the whole. I generally use them wrung out of water with mustard bran stirred in it—about a large handful to the quart of water—alternately with the plain hot pack.

The chief use of these applications is to relieve pain and internal congestion, relax tension, and as counter-irritants.

In pneumonia, pleurisy, pleurodynia, and pericarditis they should be applied to the chest in the necessary situations. In bronchitis the whole chest is better packed.

In chronic enlargement of the liver the hot pack applied daily is very useful, especially if followed by the cold douche over the affected part; to the joints and limbs in cases of rheumatism, myalgia, and sciatica; in the case of joints stiffened by disease, or rheumatism, contraction of fibrous structures, a large hot pack is a very good preliminary measure to shampooing, etc., of the affected part; to the abdomen in certain forms of peritonitis, typhlitis, etc.; to the loins in renal calculus, and in lumbago; to the spine in the early stage of locomotor ataxia, hysteria, and spinal irritation.

Cold local applications usually take the form of compresses. They are best made of an inner layer of swansdown for wetting, this covered by a piece of flannel, and then an outer layer of macintosh. Compresses are made of the size to suit the part required, and they have been most extensively abused in some so-called hydropathic institutions. I have found the abdominal compress of great service in chronic forms of constipation, especially if due to deficient peristalsis. The compress is placed over the solar plexus, the flannel forms one turn round the body, and then a thin piece of macintosh over the wetted part; this should be worn during the night, and left off in the daytime. Compresses have been largely recommended in cases of relaxed sore throat, chronic pharyngitis, etc.

A CASE OF PITYRIASIS RUBRA.

BY THOMAS COLE, M.D. LOND., M.R.C.P.L.

Physician to the Royal United Hospital, Bath.

E. S. G., æt. 33, a servant, living in a healthy country place, was admitted into the hospital on October 26, 1882.

She had had no illness since childhood.

There was no personal nor family history of any importance.

Eighteen months ago, after standing before a hot fire all the morning, she went into the air for a few minutes. She then noticed a general feeling of itching, which came on quite suddenly, and was very severe. It lasted for three weeks. No rash appeared save that induced by scratching. The itching then became intermittent, subsiding for a few hours daily, but observing no periodicity in this respect. Three months ago a little patch came on the back of the neck. Two or three days afterwards a patch came on each side of the neck. The three patches gradually coalesced. A fortnight after this she noticed one morning that the whole of the skin was in a branny condition. This got worse and worse, until the whole body became red, rough, and covered with large branny scales; in fact, the condition when she was admitted was typical of pityriasis rubra. The itching continued after the pityriasis appeared, but not so severely. Her general health was not particularly impaired, her temperature was normal, and the urine was natural. Treatment and diet had produced no effect on the complaint. Pressure on the skin, or drawing a finger-nail across it, produced a "tache," the remarkable whiteness of which contrasted strangely with the bright and vivid redness of the surrounding unirritated skin.

She was treated with citrate of potassium, with spirit of nitre, then with ergot, pilocarpin, Donovan's solution, and cod-liver oil. Externally she had soda, borax, and nitro-hydrochloric acid, and sitz-baths, with lead, borax, and lime-water lotions, and various ointments, and not the least benefit ensued. In January I advised her to leave the hospital and go to her native place, where she had resided previously to entering it. I also placed her upon half a grain of phosphorus in a pill, three times a day. From the time she commenced the phosphorus she began to improve, and at the end of two months, to her great delight, her skin was as clear and smooth as it had ever been.

Examples of recovery from this remarkable disease are so very rare, that I do not think I shall be intruding upon the space of any medical journal by relating this successful case. What may be the nature of the malady it would indeed be difficult to decide, and it may not be worth while here to discuss: but I cannot help thinking that it is due to some profound change in the vaso-motor centres, which control the superficial circulation, and that the phosphorus, by its nutrient and stimulating effects upon nerve-tissue, restored these centres to a state of tone, which was quickly telegraphed to their dependencies, and resulted in the happy termination of the case.

[Note.—In considering this case it may be said that everything turns on the diagnosis. The presence of itching and the fact of complete recovery differentiate it from most of the cases of *Pityriasis rubra* hitherto described. It will be of interest to observe whether there is any tendency to a relapse.—Junior Ed.]

THE TREATMENT OF HABITUAL CONSTIPATION.

BY F. P. ATKINSON, M.D.

I SUPPOSE there is no derangement of the system we are more frequently called upon to treat than habitual constipation, and though all kinds of medicines are suggested for its relief, they rarely produce more than temporary benefit—and it is difficult to see how the result can well be otherwise, while the root of the evil remains untouched. Now by far the more numerous subjects of this disorder are women, and as they do not seem to know that regularity is essential to the performance of every one of nature's operations, they appoint no stated times for trying to get the bowels relieved, but trust to receiving intimation when the rectal accumulation and distension can be borne no longer. This method of action may and does answer fairly well for a time, but nature gradually gets upset, the sensation of the lower bowel becomes blunted, and at last it ceases to respond to the ordinary stimulus. Then aperients are regularly resorted to, and though these act fairly well for a time they gradually have to be increased in strength and frequency. Now as regards the treatment, the first thing to be accomplished is of course to get the rectum well relieved; the next, to get the actions to take place at fixed times; and lastly, it is necessary to get more tone imparted to muscular tissue of the bowels, so that the regularity of action may be helped and also maintained. In order, then, to get the bowels relieved in the first instance, it is as well to give five grains of both compound colocynth and compound rhubarb pill at bed-time (this rarely requires to be repeated), then to take a tumblerful of cold water the next morning on waking,

and repeat it regularly at the same time each day. Should the bowels remain sluggish for some time, the same quantity of water may be taken daily before each meal. Supposing no action takes place on rising or shortly after, a small injection of warm water may be resorted to. After each movement of the bowels, a small hand-ball syringeful of *cold* water should be thrown into the rectum and retained. A soup-plateful of coarse oatmeal porridge (made with water and taken according to the Scotch method, viz. by filling half the spoon with the hot porridge and the other with cold milk) each night at bed-time, or even every night and morning for a time, is often a very great help. But above all things it is necessary for the patient to *try* and get relief at a certain *fixed* time regularly every day. If these directions are strictly carried out in their entirety, the evil, even if it has been of long standing, will generally be corrected, and the patient will improve in health and appearance. Of course, where the constipation results from exhaustion of the nervous system (such, for instance, as is brought about by self-abuse), the special cause has to be taken into consideration, and such treatment adopted as is suited to the particular necessities of the case.

Reviews.

The Collective Investigation Record. Edited for the Collective Investigation Committee of the British Medical Association by Professor HUMPHRY and Dr. MAHOMED. 8vo. pp. 190. London; July 1883.

THE Collective Investigation Committee of the British Medical Association is yet in its infancy, and it is, therefore, of no small interest to scan the first public evidence of its capacity. After an active existence of little more than a year the Committee have issued a volume by which may in some measure be gauged how far its method of research is of value. The present Record is however, it must be remembered, not to be taken as a type of its future followers, since the Committee have chosen rather to put forward indications of what may be done in subsequent numbers than to make it the first in a series. The book may be divided into three parts. The first contains a history of the movement by Professor Humphry, and addresses by Sir William Gull and Sir James Paget. The next contains the reports on the returns already received. The third consists of original communications and suggestions. The first is interesting as showing not only that the movement has the hearty support of the heads of the profession, but, what is of quite equal importance, that it is thoroughly popular in its origin. The last shows that the Committee intends to welcome suggestions from private sources, and to rely on statistical as well as clinical evidence in their researches. It is, however, to the second part that we turn to judge of the real value of collective investigation. It contains a final report on the *communicability of phthisis*, and preliminary reports on four other subjects—*pneumonia, chorea, acute rheumatism*, and *diphtheria*. These latter are professedly but indications for further work, and though the first is a final report on the evidence given, yet this was a partial and by no means exhaustive inquiry.

In answer to a question asking whether any cases had been

observed in which pulmonary phthisis appeared to have been communicated, 1078 answers were received. Of these 673 were simple negatives, 105 were negative with remarks, 39 were doubtful, and 261 were affirmative. Of the affirmatives no less than 158, or three-fifths, were cases between husband and wife, 81 were between members of the same family, 13 were cases where some members of a family and some unrelated person seemed to be infected, and 8 were between unrelated persons alone. This shows strikingly that the disease is not, like the infectious fevers, to be caught on sudden and single exposure, but needs close and prolonged contact for its conveyance. Looking into the cases which might be expected to furnish exceptions, those namely between unrelated people, we find the rule proved the more conclusively, for every instance shows close and habitual intercourse with an affected person. Another curious fact, which is strongly brought out, is the frequency of acute phthisis in the infected cases. More than half of 103 cases where the duration is given are of a rapid nature; in many the infected person took the disease and died before the infector. It is a most valuable point about the book that all the affirmative returns have been printed, and will, therefore, remain as evidence when all the Committee are dead and buried. Many of them are very striking. No. 355, for instance, tells of three female apprentices from three several villages who in turn slept with a phthisical mistress, and who all died of phthisis, though there was no trace of the disease in their families.

In the preliminary report on pneumonia several points are indicated which are of much interest. Pneumonia does not seem to be connected with any other specific infectious diseases, unless perhaps with erysipelas; it does seem, on the other hand, to be decidedly prone to recur (in 30 cases out of 350), and there are accounts of four epidemics observed. The statistics of the seat of inflammation show that the right base is affected 108 times to 86 of the left, and 76 of both together, and the table of the days of crisis brings out the seventh day as easily first, and the sixth a fair second. The chorea report gives 90 females to 32 males, and 8 to 15 as the favourite age. It was associated with rheumatism in 30 per cent. of the cases, and preceded by anæmia in 28 out of 128. Fifteen cases were recurrent; in 33 there was heart-disease; and a large number of the cases had some nervous affection in the family. Sulphate of zinc seems to be the favourite drug in treating it. Among the sequelæ, one doctor (Dr. Bernard) sent up a cast of a hand showing post-choreic paralysis and atrophy, which will we hope be engraved in the final report. This shows what thoroughly valuable material may in this way be obtained. We expect that this report will have some very good evidence on the true

relations of anæmia, rheumatism, heart-disease, and functional nervous disorder. The rheumatism report gives 114 males to 89 females, but while after 20 the males greatly preponderate, the females are three times the larger number between 11 and 15. This may be connected with the favourite age and sex of chorea mentioned above. Tonsillitis preceded the rheumatism in 25 per cent. of the cases, exposure to wet and cold occurred in 41 per cent., and over-fatigue in 23·5 per cent. The disease persisted in some of the joints in 10 per cent. We expect in the final report notes up to date on these persistent cases, and of a good many of the heart-diseases. This will be of great value. Three-fourths of the diphtheria cases were sporadic and nearly all in thinly-peopled districts. In sporadic cases the winter beats the summer list by four to one. Both these points, like many of those in the other reports, are in accordance with statistics already given, and this is worthy of notice because it shows that the returns are likely to be thoroughly trustworthy. The cases will be of value too in showing the distinction between scarlatina and diphtheria. Fifty per cent. of the cases had had scarlatina before, which shows that it does not protect against diphtheria. False membrane and glandular swelling were almost always present. Paralysis is mentioned in 25 out of 112 cases. Albuminuria in 88 per cent. of those where the question is answered. Here, too, an account of an epidemic is promised, and also a table of the statistics of the disease.

Enough has been said to show how valuable these returns will be. On the points which they investigate they will form a standard to which future writers will continually refer, and they will, we believe, be quite unique in that the observations in many instances extend over a long period subsequent to the original attack. In encouraging practitioners all over the country to co-operate in this research, we are doing them and science a good turn.

Lectures on Orthopædic Surgery and Diseases of the Joints. By Lewis A. Sayre, M.D. Second Edition. 8vo, pp. 569. London: Churchill. 1883.

Few departments of surgery have grown with greater rapidity than that relating to orthopædics, and the book now before us is, in its way, very illustrative of the fact. It is not many years since the little monograph by Dr. Sayre upon Spinal Disease and its Treatment first brought prominently before the profession in England a name even then well known to transatlantic surgeons; and when in 1876 the first edition of his larger work on Orthopædic Surgery and Diseases of the Joints made its appearance, his teaching became more widely known

and more directly canvassed. Seven years have passed, and now with a fuller and a riper experience he again brings before us the lessons he has learned. Beginning with a succinct history of his subject, he soon enters upon matters in detail, and here at the outset we are struck by the excellence of his classification of deformities, and of his reasons for their early treatment. Referring to the importance of manipulation in this respect, he relates a case of interest to every surgeon, in which, after *nine* months' confinement in a fixed apparatus, not only was the hip-joint, which was diseased, ankylosed, but also that on the opposite side as well as both knee-joints and both ankle-joints. Treating of electricity, he gives some useful rules, not only as to the length of time during which it should be employed, but as to the strength of the current, and the benefit which the more surely follows if the muscles be placed in a normal position previous to and during its employment. There seems to be no reference to the form of current which is most beneficial.

To many a surgeon there has occurred the difficulty of determining in certain cases whether it is best to divide a muscle or tendon before the application of an apparatus, or to trust entirely to the force he can thus employ. Help may be had from this rule of Sayre's: Place the joint contracted as nearly as possible in its normal position by manual tension and so retain it; while the parts are thus on the stretch make additional point pressure with the end of the finger upon the tense parts—if *reflex contractions* result, that tendon, fascia, or muscle must be divided.

The doctrine that talipes is, as a rule, of paralytic origin is strongly urged; and the necessity for very early treatment insisted on. Of the ingenuity and patience brought to bear in the management of this class of deformity, the cases narrated and the illustrations given afford ample evidence. Concerning the part played by traumatism in the production of joint-disease there is to-day less dispute than formerly, and no small part of the change in belief is due to the doctrines of Dr. Sayre. Yet we cannot accept them in their entirety, as the constitutional elements must from time to time play a sadly important part. None the less however do we acknowledge the importance of rest and ease after every injury in which an important joint is involved.

The chapters on the Treatment of Joint-disease are full of sound teaching; and much as some may cavil at the after results in cases of excision of the hip, and deprecate the operation, we believe that were it always performed according to the rules here given there would be fewer disappointments. The lectures on Spondylitis and Rotary Lateral Curvatures have been largely re-written, and their teaching has undergone

certain alterations. That the plaster jacket should still as a curative measure hold a foremost place is but natural, although the reasons that have been urged against it are not very fully met. It must however be acknowledged by all to be the parent measure from which all modifications have had their origin, and that in spite of its admitted disadvantages it has proved of well-nigh inestimable value, and has been attended in very many instances with the most signal success. By means of it we had the first demonstration of the practicability of keeping a diseased spinal column in extension and at rest, and of the benefit which follows such a position.

The treatment of contracted limbs by *brisement forcé* has not been accepted as an entirely satisfactory procedure. Disaster has frequently attended its employment, dependent partly on a bad selection of cases, partly on the fact that it was not judiciously carried out. What Dr. Sayre has to tell us on both points will help to a surer success; his own cases are certainly most gratifying in their results.

Full as the book is of striking and suggestive thought, it is not without defects. Letters and cases are too largely interspersed, too much given in detail, while some lectures—notably those on Malformations and on Genu Valgum and Varum—are very defective. We quite believe that the two last-mentioned deformities can be cured by special apparatus, but if we take into account the very long period over which these must be worn, the money they cost, and the somewhat of uncertainty that exists as to the issue, surgeons will, we consider, be more inclined to deal with them by operation. There are not many surgical procedures which have given better results with the same minimum of risk than does osteotomy. The chapter upon Congenital Phimosis, suggestive and interesting in its way, seems rather overdrawn. Reflex irritation from this source giving rise to an almost spastic condition of the lower limbs one can understand; but it is not so easy to associate *optic neuritis* with such a cause. But the defects of the book are small, and the lessons taught by it are good and valuable, so valuable, that the man must be learned indeed who does not rise from its perusal a better and a more trustworthy surgeon.

Clinic of the Month.

Syphilitic Fever.—Dr. Duflocq relates the history of a young man, twenty-five years of age, who was admitted to hospital suffering from a fever. The attack had begun eight days previously with headache and vertigo followed by vomiting, after which fever and diarrhœa came on. There was also epistaxis a few days later. On admission the patient presented nearly all the symptoms of typhoid fever: the tongue was white; there was tenderness on pressure in the right iliac fossa, though the belly was not tympanitic; the spleen was slightly enlarged; heart and lungs were healthy. The temperature was 104°·7. The eruption of rose-coloured lenticular spots was confluent over the abdomen, and very thick over the arms, legs, and thorax. They were large, slightly elevated, and disappeared momentarily on pressure. It was the great extent of this eruption that excited suspicion and led to further examination. A cicatrix resting upon an indurated base was found upon the glans penis, and there were enlarged glands in the groin. Mucous patches were discovered in the mouth and fauces. The patient was placed upon ordinary anti-syphilitic remedies, and the fever and eruption disappeared in about two weeks. Dr. Duflocq mentions as of diagnostic value in the differentiation of typhoid from syphilitic fever, the early appearance (third or fourth day) and the abundance of the eruption. (*La France Médicale*, August 30, 1883.)

Plaster Jackets.—What has been termed the "plaster-jacket craze" has so far expended itself that there is danger that the advantages of the method may be overlooked. The discussion in Berlin relative to the method is therefore of interest. Sonnenburg reports his experience in 205 cases (of which, however, only twenty-two were antero-posterior curvatures, the rest being lateral curvature). The jackets were applied on patients suspended from the head, not by the axillæ, the shoulders being free. The bandages were put on with moderate tightness forward and backward, and pressure was

made on the moist plaster by the hands of assistants. A renewal of the jacket was made in about six weeks, and after a while a leather corset was substituted and gymnastics (in lateral curvature) employed. The reporter found correction of the curves to take place under light suspension in moderately severe and even in some marked cases, and in the very obstinate curves some benefit appeared to be gained in the arrest of the progress of the disease. Felt and leather corsets Sonnenburg did not advise in the early stages of progressive disease. Küster also found jackets of service in lateral curvature and in caries, but in the latter case Sonnenburg did not agree with him. Eulenberg, on theoretical grounds, is opposed to the use of the plaster dressing with suspension in caries of the spine. (*Centralblatt f. Chirurgie*, No. 18, 1883.)

Alternate Hot and Cold Applications in Internal Strangulation.—A man, forty-two years of age, who had some years previously suffered from a severe attack of peritonitis, was suddenly seized with violent colic. There was meteorism, the abdomen was generally tender on palpation, but more especially at a point a little to the right of the umbilicus. There was no passage either of fæcal matter or of gas from the bowel, and purgatives, whether administered by the mouth or the rectum, brought no relief. The obstruction of the bowels continued several days, despite an active and varied treatment, stercoraceous vomiting set in and the patient was rapidly sinking. At this time, all other measures having been tried in vain, Dr. Roux determined to try the effect of the alternate application of heat and cold to the abdomen. An ice-bladder was first applied and retained for an hour, then it was removed and compresses as hot as could be borne were placed over the abdomen. These applications were continued every hour through the day and night. In the evening some gas escaped from the bowel, and the following morning there was a slight stool. A mild purgative was now given and was soon followed by a copious evacuation, and the patient speedily recovered. (*Lyon Médical*, Sept. 9, 1883.)

The Significance of Appearances of the Tongue.—A course of lectures on diseases of the tongue, delivered by Mr. Jonathan Hutchinson before the Royal College of Surgeons, is now appearing in the *Medical Press and Circular*. At the conclusion of the introductory lecture we find some suggestions of a practical nature regarding the interpretation of tongue symptoms, which we quote :—First, we must avoid assuming hastily that the condition present has any connexion with the disorder for which the patient consults us. Many patients have habitually a profuse growth of filiform papillæ

and great tendency to the accumulation of fur. In others the papillæ are curiously absent, and the tongue may look bare or rough. In others the furrows may be well marked, and the peculiar fern-leaf pattern present, and yet these several conditions may imply nothing whatever as regards the patient's health. In all conditions of peculiarity it is well to inquire whether the patient has ever at any former time been salivated or suffered from sore mouth. For it may easily be the fact that some attack of stomatitis, long past, may have left the tongue flabby, indented at its edges, fluted on its surface, or more or less bare. In cases in which we have satisfied ourselves that the conditions shown are neither personal peculiarities nor yet the consequences of previous disease, we ought next to inquire carefully whether any local conditions are present in the mouth which will explain them, and by no means jump to the conclusion that they denote disorder of the stomach or liver. If the tongue is dry we inquire whether the nostrils are stopped, and if it is sore we must examine the teeth and ascertain whether from sharp, broken points, from stopping with amalgam, or accumulation of tartar, any possible source of irritation exists. If we have failed to discover in the mouth any cause for disease on the surface of the tongue we must still hesitate as to suspicion of visceral or blood disorder, and ask whether it be not possible that some irritant may have been introduced in the way of food. There are many fallacies in this direction. Lastly, if we feel able to confidently exclude all local causes, and obliged to believe that the state of the tongue is in direct connexion with the state of the bodily health, we have still before us the difficult task of deciding as to what the nature of the bond of connexion may be. The state in question may still possibly be in no way symptomatic of other disorder, and not in any degree consequent on it, but rather part of the general disease. Above all we must be on our guard against believing that the state of the tongue is a trustworthy criterion as to that of the mucous membrane of the stomach, and remember that for the most part a furred tongue implies that no food has been eaten and little more, whilst glossitis and gastritis are conditions which are mutually independent, and but seldom coexist.

Errors in Examining the Urine for Sugar.—The following illustrates with what care and precaution every urinary examination in regard to the presence or absence of sugar ought to be made. Professor von Heusinger, in a recent session of the Aerztl. Verein in Marburg, declared that a certain individual desired to be examined in view of having his life insured. At the close of the physical examination he was requested to

urinate. As he had micturated before entering the doctor's office he now could pass but a slight amount. The chemical examination gave a yellowish-green precipitate (saccharine). At the examiner's request the man returned the next morning, and the urinary test presented a negative result. It turned out after a close questioning that the individual had suffered for months with gonorrhœa, and had used injections of sulphate of zinc. He had passed water and used this injection just previous to presenting himself for the first examination. Dr. Fettien, who was then consulted, found that if a solution of sulphate of copper is added to one of sulphate of zinc and tartaric acid and caustic soda in excess, a blue fluid is formed which contains, besides the constituents of Fehling's solution, sulphate of zinc. Added to boiling urine, the zinc is precipitated as a hydrate with a greyish-green colour and the solution turns from blue to yellow. If albumen is added the same phenomena are observed, only the fluid above the precipitated zinc is reddish. (*Berl. klin. Wochenschrift*, 1883.)

Aphthous Vulvitis of Children.—Sarazin (*Thèse de Paris*, July 1883) gives the following conclusions regarding this affection. (1) Aphthous vulvitis is a well-marked disease. It is peculiar to little girls from two to five years of age. Rare in private practice, it is observed especially in hospitals. (2) Measles is the principal cause of this affection. It furnishes two-thirds of the cases. (3) Gangrene of the vulva has most frequently aphthous vulvitis for its point of departure. (4) The prognosis, which was unfavourable before the employment of the iodoform treatment, has become quite favourable since the introduction of this agent as a topical application. (5) The treatment consists in sprinkling the affected parts with iodoform powder, and keeping them separated with pledgets of lint. The internal administration of tonics is a useful adjuvant of the local treatment. (*Journal of Cutaneous and Venereal Diseases*, Oct. 1883.)

Naphthol in the Treatment of Skin Diseases.—Dr. Arthur van Harlingen, of Philadelphia, reports the results of his experience with the use of this drug, which was first brought to the notice of the profession by Professor Kaposi, of Vienna, about two years ago [*Practitioner*, xxviii. 137]. He finds it is one of the most efficient and agreeable remedies for *scabies* which has as yet been brought forward. Both in the rapidity of its action and in its beneficial effects upon the inflamed skin, it is superior to any of the means ordinarily employed for the cure of this disease. Its exact place in dermatic therapeutics remains to be ascertained, but he is inclined to think that it will not prove an unimportant one. In *eczema* it

has failed in his hands to give the same beneficial results as were obtained by Kaposi. In most cases of vesicular and in acute eczema generally its action is simply that of an irritant. On the other hand, it has a limited field of action in the cure of a certain number of cases of squamous eczema of the scalp. In his opinion it is a valuable addition to our external means of treatment in *psoriasis.* Kaposi speaks well of it in psoriasis of the scalp in particular, and his experience would lead him to place it near chrysophanic acid and pyrogallic acid in effectiveness without the neutralising disadvantages of either of these drugs. In *seborrhœa* of the scalp naphthol is a decided addition to our means of treatment. While inferior in some respects to sulphur or carbolic acid, it has a certain range of usefulness which further experience will in all probability more exactly demonstrate. Naphthol is highly lauded by Kaposi in the treatment of *hyperidrosis,* but in Dr. van Harlingen's hands it has failed entirely, although used strictly according to his formulæ. He considers it quite valueless in this disease, so far as his experience goes. His experience leads him to regard its effects in *ringworm* as inferior to almost all of the remedies at present used, and as almost entirely inefficient in most cases of *tinea versicolor.* In general *pediculosis* he has had no experience, but in a single case of pediculosis capitis its action was favourable. (*American Journal of the Medical Sciences,* Oct. 1883.)

In a paper on "Naphthol: its Medicinal Uses and Value," read before the Philadelphia County Medical Society on the 17th Oct., by Dr. John V. Shoemaker, Physician to the Philadelphia Hospital for Skin Diseases, that distinguished dermatologist calls attention to naphthol in a manner calculated to ensure for that drug a more extensive trial by the profession of the United States than has yet been accorded it.

Naphthol is a derivation of naphthalene, a hydrocarbon found in large quantities in coal tar, belonging to the so-called aromatic group. It bears the same relation to naphthaline that phenol does to benzol, and cresol to toluol. It was first employed by Professor Kaposi as a substitute for tar in skin diseases, being considered by him as the essential curative ingredient of that substance, while being free from its objectionable features. The preparation employed in the cases which form the basis of Dr. Shoemaker's report was that made after the method of Dr. Justus Wolf, being free from odour and coming in beautiful crystalline scales. This preparation decomposes under the influence of heat, when it again becomes odorous and pungent. The commercial naphthol contains impurities which unfit it for use in medicine. Naphthol thus properly purified is an extremely powerful antiseptic and disinfectant. One part added to 480 of urine kept the latter from decomposing for six months, while

another sample of the same urine to which naphthol was not added had a strong putrid odour at the end of eight days. The addition of the naphthol to this putrid sample divested it of all odour within twenty-eight hours.

Dr. Shoemaker's therapeutic experiments extended through some nine months and sufficed to convince him of the great value of naphthol in medicine. He found it to fully sustain the claim that Kaposi had made for it in scabies, psoriasis, and chromophytosis, as well as in some of the chronic forms of eczema, in which it not only allayed the itching attendant thereon, but lessened the infiltration as well. In wounds and indolent ulcers it is a most useful detergent and deodorant, removing the fœtor and establishing healthy action of the parts. Aqueous solutions, containing half grain to the ounce, were used to great advantage as vaginal injections, especially in leucorrhœa and uterine carcinoma, as well as in gonorrhœal affections, both in male and female. In diphtheritic throat affections it made a most useful gargle, as well as to remove the fœtor of catarrhal and other affections of the buccal cavity. Its greatest value, however, arose from its disinfectant action on the evacuations of fever patients and in rooms containing them, while by its absence of odour it did not tend to produce inconvenience either to patient or attendants. Combined with powdered talc or starch, or both, and dusted into the shoes or stockings of those affected with fœtid exhalations of the feet, it acts most satisfactorily, and its effects are equally as good in the same affection involving the hands, axillary and inguinal regions. Combined with other ointments in the proportion of from one to ten grains to the ounce, it not alone preserves the unguent from decomposition, but exercises also an antiseptic action on the parts and the exudation therefrom. A slight admixture to an experimental sample of lard preserved the same in excellent condition throughout the hot summer months. In chronic psoriasis, particularly when there was great infiltration, the use of a five to fifteen per cent. ointment was frequently attended with good results. It also proved very effective in squamous and fissured eczema, used in combination with lard or gelatine.

After his long and successful employment of naphthol Dr. Shoemaker was surprised to find that serious untoward effects had been reported from its use by foreign authors. With a view to further testing its toxic properties he first administered it to a rabbit internally in a saturated solution. But on discovering no injurious effect he selected another rabbit which he determined to poison with a view to observing the post-mortem appearances. He accordingly gave it at first one-grain pills of naphthol every three hours, and subsequently increased the amount to two grains and again to four grains at the same

intervals. But beyond increasing the animal's appetite no effects were apparent. Following these experiments two of his assistants took numerous and large doses (reaching as high as five grains twice a day) without other effect than a sensation of temporary warmth in the epigastric region after each dose and subsequent slight vertigo and buzzing of the ears, with other evidences of hyperæmia. The alvine evacuations were softened to a mushy consistence and changed to a clay colour; in one instance diarrhœa occurred. The deduction from these experiments clearly is that in the case of the ill-effects reported an impure preparation had been employed.

Dr. Shoemaker pronounces purified naphthol to be far superior to carbolic acid and the other antiseptics which have been in vogue, while it is almost absolutely odourless. It has the advantage also of being cheaper than carbolic acid, when the amount required to produce its effect is considered. [*Pract.* xxviii, 137, 298; xxix, 60.] (*Pharmaceutical Journal*, Dec. 1, 1883.)

Treatment of Spasmodic Winking.—Under this head Dr. Friedreich Betz relates the history of a boy, fourteen years of age, who had suffered for several years from a bilateral nictitating spasm of the eyelids. Several physicians had attempted to relieve him, but in vain. The boy was healthy, and his eyesight good. He had, however, very long eyelashes and the edges of the lids were reddened. Betz performed epilation of numerous lashes above and below on both eyes. The treatment was immediately successful. (*Memorabilien*, Aug. 1883.)

The nature of the Prurigo Papule.—Although there has been much written about, and many descriptions made of, the histology of the prurigo papule, the opinions of authors have not always agreed: and it was with the idea of settling as far as possible the disputed points and differences that Dr. Robert B. Morison, of Baltimore, undertook the following investigations in Professor Chiari's pathological institute at Prague, on material kindly furnished by Professor Pick, which was taken *intra vitam* at various stages of the disease under the latter's personal supervision. Dr. Morison draws rather different conclusions regarding the formation of the papules, when considering them in their earliest and latest stages. He considers that the papule is formed by an infiltration beginning around the upper layer of vessels of the corium, and that this infiltration extending upwards surrounds the papillary vessels, enlarges the papillæ, thus pushing up the epidermis, which becomes thickened at an early stage above them, and at last penetrating it, forms within its layers a small vesicle containing serum, blood, and lymph-cells. The signs of infiltration surrounding the hair-sheaths and

sweat-ducts are secondary, and they play no especial part in the process. Their presence in the papule is accidental, and it is certain that the primary changes in the skin are not in connexion with them. The colour of the papule at first does not differ from the rest of the surrounding skin, on account of the depth of the slight infiltration with which it begins. For the same reason it is at first only felt, and not seen, as the infiltration has not extended high enough to push up the epidermis perceptibly, but is sufficiently great to give a feeling of knot-like hardness underneath it. He considers the whole process due to an inflammation, and that all the signs of chronic dermatitis follow regularly, according to the length and duration of the disease, and the amount of scratching to which the itching, as a secondary symptom, gives rise. Clinically the history of the papule coincides with this description, for there is always noticed in the beginning of the disease, after careful investigation of the skin, a slight roughness, and a sensation as of running the hand or finger over small knots, covered with an intervening membrane. At this stage there is no itching. In fact, the itching does not begin until the infiltration has so far advanced that the papules are more distinct. If before this occurs the treatment is begun, no itching appears. This proves, as Kaposi says, that all the symptoms of the disease go hand in hand with the increase or decrease of the papules. (*American Journal of the Medical Sciences*, Oct. 1883.)

Extracts from British and Foreign Journals.

Strength of Commercial Nitrite of Sodium.—The papers on the use of nitrite of sodium by Dr. Hay, in the *Practitioner*, having drawn attention to this drug, the strength of it becomes a matter of considerable importance. This has been clearly shown by the results of Dr. Ringer's experiments upon animals, and the disagreeable effects observed by Dr. Murrell in some of his patients from administration of the drug. Mr. McEwen has examined a number of specimens and he finds them vary enormously, some of them containing only a mere trace of nitrite—0·011 per cent., whereas others contain no less than 98·5 per cent. The large and transparent crystals are almost invariably worthless. The fused nitrite is also weak, whereas the small crystals contain a large proportion of true nitrite. As the drug deteriorates very much when kept in stock for a few months, its strength should be ascertained from time to time by analysis. (*Pharmaceutical Journal*, p. 121, No. 684.)

The Strength of Spiritus Ætheris Nitrosi.—The strength of this preparation has been examined by Mr. Symons, and he finds that it varies exceedingly, some preparations containing as much as 4·08 per cent., and others as little as ·18. From the wholesale house which supplied him with the specimens containing 4·08 per cent. other samples were obtained indirectly by purchase, and these contained respectively only ·46 and ·35 per cent. The author thinks that probably the great variability of this preparation is due to the want of proper care in condensing the distillates by means of ice. (*Pharmaceutical Journal*, p. 281, No. 694.)

Treatment of Corneal Opacities.—Dr. Michel recommends sulphate of cadmium, of the strength of two and a half grains to the ounce of mucilage, as an application to opacities of the cornea. A camel's-hair brush, dipped in this wash, is applied to the centre of the spot and retained in contact with it

for a few seconds. At first the application is made once a day, but after a while is repeated two or three times in the twenty-four hours. When the pain grows less, the strength of the solution may be increased to five grains or even seven grains to the ounce. When the opacity is of recent formation it rapidly disappears under this treatment, but when it is of old date the applications must be long continued. (*Revue Médicale*, Aug. 11, 1883.)

Phosphate of Codeia.—Dr. Fronmüller employs the phosphate of codeia for hypodermic injection. He says that it possesses the advantage over the muriate and sulphate of being much more soluble. The substance crystallises in slender, four-sided columns, is white in colour and of a bitterish taste, and is soluble in four parts of water. Its action is very like that of morphia, but it is milder, and the symptoms of poisoning (such as great weakness, intense headache, bilious vomiting, etc.) are much less often encountered. It seldom causes local irritation when subcutaneously injected. The dose should be at least double that of morphia. The phosphate of codeia is especially recommended in the case of women and children. (*Memorabilien*, July 16, 1883.)

Resorcin as a Local Application.—Dr. Bombin has made extensive trials of resorcin, oxyphenol, or diatomic carbolic acid ($C_{12}H_6O_4$), as a local application. He uses the drug in the form of alcoholic solutions of different proportions. The first, of equal parts of resorcin and alcohol, has a distinctly caustic action; the second, of one part of the acid to ten of alcohol, and the third of one to twenty, are stimulant and antiseptic. A one per cent. solution is found to prevent decomposition perfectly. In obstinate syphilitic ulceration, Dr. Bombin first cauterises the surface of the sore with the 50 per cent. solution, and then applies the 10 per cent. solution night and morning till the eschars are separated, and afterwards the 5 per cent. one till cicatrisation is complete. He speaks most highly of his success in cases which had been before very intractable. As a local application he has had very good results in orchitis and epididymitis with a 6 per cent. solution, and uses a 1·5 or 2 per cent. solution with good effect to wash out the bladder, but he considers that it acts in the latter cases simply as a local disinfectant. Moreover, he has not found that, taken internally, it has any curative action in such cases, as has been stated, and similar indecisive results followed its internal administration in cases of strumous glandular affections. In epithelioma of the cervix uteri, its local action does not seem to differ at all from that of carbolic acid; taken internally in large doses, the drug appeared to exercise a certain arresting influence on the spread of the disease, and there was

some attempt at cicatrisation. On the whole, it is plain that, in Dr. Bombin's opinion, resorcin is a very valuable local application for chronic tertiary ulcerations, exerting on them a distinct curative action, but that the value of the drug when taken internally is doubtful, and that, as a local application, in most cases it is not superior to carbolic acid as a disinfectant, save that it has less smell, and is more soluble in water, ether, and alcohol. [*Practitioner,* xxxi, 303.] (*London Med. Record,* July, 1883.)

Eczema Capitis.—In the ordinary eczema of the head in children, so commonly met with in dispensary practice, after two or three thorough cleansings, the daily application of the following salve nearly always suffices to obtain a rapid and lasting cure.

℞ Acid. Salicylic.	.. ..	gr. x.
Tinct. Benz.	.. .. ..	♏ xx.
Vaselini	.. .. ..	℥ j.

M. ft. ung.

On other parts where a soft, easily melting salve such as this is not suitable, or where a firm dressing or a drying effect is desired, the following paste should be rubbed on.

℞ Acid. Salicylic.	.. ..	gr. xix.
Vaselini	.. .. ..	℥ j.
Zinci Oxidi, Amyli	.. ..	aa. ℥ ss.

M. leniter terens, fiat pasta. (*Edinburgh Medical Journal,* Sept. 1883.)

Fluid Extract of Senega.—Mr. H. J. Rose finds that the tendency of fluid extract of senega to deposit a precipitate is prevented by the addition of spirit of nitrous ether to the alcohol employed. (*Canadian Pharmaceutical Journ.,* Aug. 1883.)

Plastic Clay for Suppositories.—The use of plastic clay as a convenient material for suppositories in some cases is recommended by Dr. Trippier (*L'Union Pharmaceutique,* xxiv, 398). The ordinary sculptor's modelling clay is used, the medicaments being dissolved in water and then worked into the mass; in this way salts of iron and copper, alum, or even vegetable extracts, may be incorporated by taking proper precautions. It is proposed to supply patients with the medicated clay, so that they can break off a portion and mould it between the fingers as required. There are difficulties in the way of maintaining the proper consistence. These accidents may be overcome by keeping the clay under a bell-glass in a moist atmosphere, or by the employment of glycerine, which is also said to have the additional advantage of giving stability to a mixture containing iodide of potassium. The formula for such a mass is: clay,

500 grammes; water, 50 grammes; potassium iodide, 30 grammes; glycerine, 100 grammes. (*Pharmaceut. Journ.*, Sept. 29, 1883.)

Carbolised Sawdust in Antiseptic Surgery.—Mr. H. P. Symonds, Surgeon to the Radcliffe Infirmary, advocates the use of this material as a dressing for wounds. He says: "One of the drawbacks of the usual antiseptic dressing is the rapidity with which the discharges come through on the first day or two after operation, often necessitating the redressing of the case within a few hours. To prevent this, and yet not to interfere with the aseptic condition of the wound, is a distinct advantage both to the patient and the surgeon. The material I have used recently in a considerable number of cases is coarse sawdust, soaked in (1 in 10) solution of absolute phenol and spirit of wine, then allowed to dry slightly so that the spirit may evaporate, leaving the sawdust charged with carbolic acid. When used it is enclosed in a bag made of several layers of gauze, and applied outside the deep dressing, the usual external dressing being put over it. The sawdust thus takes the place of the padding of loose gauze which is generally used. Its absorbent power is very great, and it has the additional advantage of keeping up an equable pressure on the divided tissues. I find that fourteen ounces of sawdust will readily absorb about one pint of liquid." He reports five cases, two of amputation, two of operation for tumour of the mammary glands, and one of compound dislocation of the elbow, in which it was used. In all these cases primary union took place without any formation of pus. In only one did the temperature reach 100°, and that on the day after operation, after which it became normal. "I have not quoted these cases as being at all remarkable, but merely as common instances in antiseptic surgical practice in which the sawdust dressing was used. Surgeon-Major Porter, in *The Surgeon's Pocket-book*, states that he has used sawdust as a dressing in suppurating offensive wounds; but I am not aware that it has been tried, when prepared in the way I have described, in antiseptic dressing. The three points in its favour are its powerful antiseptic qualities when saturated with carbolic acid, its great absorbent power, and its adaptability to any surface. I may add that the sawdust should be coarse, as I find that if it is very fine it passes through the gauze and irritates the skin." (*Lancet*, Sept. 22, 1883.)

Oleate of Quinia.—Dr. Squibb, in his *Ephemeris*, considers that oleate of quinia, although it has not attracted general attention, is probably one of the most important of the oleates. From the larger quantity of quinia needed in medicine, this oleate is made as strong as possible. While a normal oleate would by calculation contain about 53 per cent. of the alkaloid,

it has been found impracticable to dissolve that quantity in the acid. In a series of experiments made some years ago when this oleate was introduced, it was concluded that 25 per cent. was the best proportion. But as the quinia of the market holds some hygrometric moisture, it is better to take 26 grains of the alkaloid and 74 grains of oleic acid as the formula. The alkaloid is simply rubbed to powder, and added to the acid in a bottle. Like the other alkaloids, this dissolves so readily that, being in much larger proportion, it is liable to clog together and be slow in dissolving. But this clogging together is easily broken up by means of a glass rod, or the solution may be effected in a capsule, and the clogging be prevented by a pestle. In this way it is easily made in a few minutes. A fluid ounce of this oleate weighs about 410 grains, and therefore contains about 102 grains of quinia, which is equivalent to about 140 grains of the ordinary sulphate of quinia; therefore, a fluid drachm contains the equivalent of about 17 grains of the sulphate, and a minim is equivalent to a little more than a quarter of a grain. A hypodermic injection of a fluid drachm will, therefore, carry the equivalent of 17 to 18 grains of sulphate of quinia. It happens, perhaps, oftener with the administration of quinia than most other medicines, that the physician wants to save the stomach; and many conditions need quinia when the stomach will not accept it, or will not utilise it if given by the mouth. These circumstances have long indicated the hypodermic use of quinia, but up to this time no solution has been proposed that is well adapted to hypodermic use, first, because of the large dose required, and again, because of the sparing solubility of available quinia salts. Hence this oleate has been sometimes used hypodermically, but with what success is unknown to the writer. The epidermic use, however, is of late not uncommon, and, since it was first proposed, occasional trustworthy testimony from private sources has led the writer to consider it an important adjunct to the more common methods of using quinia. The quantity of oleate needed here is considerable, often amounting to one or two fluid drachms. Hence it should always be applied under oiled silk or gutta-percha tissue. When put directly on the skin, a minim will require about four square inches of surface or it will run, and a fluid drachm would require about two square feet of surface, an area hardly accessible under ordinary circumstances. But two pieces of very thin fine old muslin or linen, six by nine inches, will easily hold half a fluid drachm each, and may be applied to the inside of the thighs, covered by oiled silk. This leaves the abdomen available for another similar application if desirable, and the oleate can be renewed on these places as rapidly as it is absorbed. Another good way of applying it,

especially in walking cases, to get a moderate continuous effect, is to anoint the spinal tract for an inch or more on each side of the spinous processes, morning and evening, with a half fluid drachm, and cover it with a strip of oiled silk under the clothing. The writer has heard of several instances in which a ringing in the ears was speedily produced by such applications of the oleate. (*Brit. Med. Journal*, Oct. 27, 1883.)

The Action of Platinum Salts.—This subject has been investigated by Dr. F. Hofmeister under the direction of Prof. Schmiedeberg. Platinum produces in frogs an irritation of the centres of voluntary motion evidenced by convulsive twitchings and more rarely well-marked convulsions. It paralyses the voluntary muscles by destroying the irritability of the muscular substance. In warm-blooded animals it produces vomiting and bloody stools, which are due, like those caused by arsenic, to great dilatation of the intestinal vessels. The action of the compound ammonias containing platinum differs entirely from that of platinum itself, excepting in so far as the twitchings or convulsions caused in frogs by platinum may be compared with the convulsions (resembling those of picrotoxin) which the compound platino-ammonias produce. Ammonium and its salts cause tetanic convulsions, which are due to an action both in the medulla oblongata, and on the spinal cord. The platino-ammonias produce convulsions which are like those of picrotoxin, but they appear to do this by an action on the cord and not on the medulla. Unlike ammoniacal salts, the platino-ammonias do not affect the blood-pressure. The platino-ammonias are not decomposed in the body into platinum and ammonia, and their physiological action is due to the substance itself and not to products of its decomposition. Notwithstanding this, an alteration in the number and mode of combination of the two components of the molecule exercises a marked influence over its physiological action. Those compounds which contain platinum and ammonia in the ratio of one to two, viz. platosammonium, platosemidiammonium, platinosemidiammonium nitrate, and platinammonium chloride, have essentially the same physiological action, which consists in frogs of a primary increase of reflex excitability, convulsive attacks of a tonic character which all persist after ablation of the medulla oblongata, muscular quivering, and veratria-like prolongation of the muscular curve. The irritability of the voluntary muscles remains longest unaltered. A curare-like action on the ends of the motor nerves is only observed in profound poisoning. The action of the heart becomes gradually slower, and this effect can only be diminished to a slight extent by atropia. In rabbits non-poisonous doses of this substance

cause attacks of cerebral excitement with cries of pain and attempt to flee; these attacks are separated by intervals of about a quarter of an hour from each other which are apparently periods of perfect health and comfort; well marked convulsions do not occur. Platomonodiammonium chloride, which contains three of ammonia to one of platinum, produces similar symptoms in frogs—increased reflex excitability, convulsions, fibrillary twitchings, and veratria-like contractions of muscle; but the symptoms are generally better marked. The convulsions are not tonic, but have a picrotoxin-like character, and the curare-like action on the motor nerves is more distinct. In rabbits the symptoms are similar to those already mentioned, but the recurrent attacks have a well-marked epileptiform character, which are no longer prodromata, as in the former case; but loss of consciousness and more or less well-marked convulsions are the important symptoms. Two bases which contain platinum and ammonia in the proportion of one to four, platoso- and platinodiammonium chloride, have different physiological actions; the platosodiammonium chloride forms an exception to the other platinum bases, inasmuch as it is comparatively non-poisonous to rabbits. In frogs it produces similar symptoms to those already mentioned, only a larger dose is required. Platinodiammonium chloride on the contrary differs considerably from the others in its physiological relations. Like that it produces convulsions in frogs, and epileptiform attacks in rabbits; but these symptoms are sooner or later masked by a curare-like action on the irritability of the motor nerves, so that sometimes the symptoms of paralysis and sometimes those of irritation are best marked. The symptoms of irritation are so masked by the curare-like action that in the frog they do not appear at all, and in the rabbit they only appear as rudimentary twitches. If the platinodiammonium chloride is excepted, the other bases form a continued series in which the symptoms of poisoning undergo a regular alteration, corresponding to the increase of ammonia in a molecule of the substance, and this is marked both in the frog and in the rabbit. The platinum bases have a double action: (1) a central one which affects the organs of spontaneous movement in such a way that in the frog the chief effect appears to be on the spinal cord, and in the rabbit on the brain. It is best marked in platomonodiammonium chloride, and is almost as strong in the three other bases which are poor in ammonia, but is not entirely absent in those which are rich in ammonia; (2) a peripheral curare-like action of which merely a trace is observed in the action of the three compounds which are poor in ammonia, but which becomes clearly marked in the platomonodiammonium chloride, in the platinodiammonium chloride forms a prominent

symptom, and in the bases richest in ammonia is almost the only symptom. The influence of the constitution of the platinum bases on the physiological action may be thus formulated: an increase in the number of the ammonia groups within the molecule increases the curare-like action, while the mode of combination within the molecule as well as divalence or quadrivalence of the platinum in it is of no importance for the toxic action. This rule however does not apply to the platosodiammonium chloride, though why this should have such a much less toxic action than the other platinum bases cannot at present be decided. It does not appear to be due to the different valency of the platinum atom in it, as platinum in the form of a double sodium salt appears to have a similar action whether it is applied as a platinous or plántinic chloride. It is possible that the platosodiammonium chloride which in its chemical relations approaches much nearer to an ammoniacal salt than the other platinum bases, is changed in the body by conversion into some indifferent compound, and so becomes harmless. The muscular quivering which the platinum bases produce is due to a peripheral action, as it remains after section of the motor nerves and does not occur when the poison is prevented from reaching the muscles although the nerve-centres have been poisoned. The observations of Luchsinger—that poisons which cause muscular tremors also produce salivation—is corroborated by the action of the platinum bases. (*Archiv für exper. Path. und Phar.* p. 393, vol. xvi.)

Artificial Coumarin.—Coumarin is the odoriferous principle of the tonka bean, woodruff, sweet-smelling grass, and other plants, which owe their aroma and value exclusively to the coumarin they contain, the other principles being not only valueless but disadvantageous. Coumarin has now been made artificially: one method of preparation is by warming sodium salicylaldehyde ($NaC_7H_5O_2$) with an anhydrous acid, or by boiling salicylaldehyde with sodium acetate and anhydrous acid. Recent improvements in the process have greatly shortened the time and expense. (*Pharmaceutical Journal*, Sept. 8, 1883.)

Notes and Queries.

Café Vierge.—This is a strong extract of coffee prepared by a new process. A teaspoonful added to a small cup of boiling water or milk makes a very well-flavoured and pleasant cup of coffee. It has not the adventitious sweetness and "medicinal" taste of the essences hitherto in the market, and, so far as we can make out, is as pure as it is guaranteed to be. The ease and certainty with which clear, hot, and highly refreshing coffee can be made by using this extract should tell in its favour with medical men and night nurses. It can hardly be called cheap as yet, but perhaps the first "issue" has to bear the expense of the months of experimenting in the pharmaceutical laboratory which we are told preceded its invention. Messrs. Ridgway, and Allen and Hanburys are the joint proprietors.

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⁂ Any of the foreign works may be procured on application to Messrs. DULAU, of Soho Square, W.C.; WILLIAMS and NORGATE, of Henrietta Street, Covent Garden, W.C.; or BAILLIÈRE, of King William Street, Charing Cross.

Department of Public Health.

ISOLATION ROOMS AT INFECTIOUS HOSPITALS.

In a recent number (October 1883) we published a paper by Mr. Charles E. Paget, Medical Officer of Health for the Westmoreland Combined Sanitary District, on the construction of school sanatoriums. The special application of the paper to the purposes of educational establishments did not, however, prevent its embodying nearly all the more recent experience available as regards the construction of hospitals for infectious diseases for general sanitary purposes; indeed there are but few sanitary authorities who possess means of isolation so perfect as those described in Mr. Paget's paper. But in one respect a school sanatorium differs somewhat from the ordinary infectious hospital; it is rarely in use for more than one disease at a time, and hence when either two separate pavilions, or a detached convalescent room, have been provided, there is generally ample accommodation for the isolation of special cases. In ordinary sanitary districts, however, the reverse is the case. Two separate diseases are often simultaneously under treatment in two separate ward-pavilions, and further accommodation is often required. Thus, it is often important to remove from a general ward patients who, by reason of noisy delirium or otherwise, are a source of annoyance to the other inmates; some persons whose isolation it is specially necessary to secure in the interests of public health, such as the members of the families of dairymen, drapers, licensed victuallers, and other tradesmen, will frequently only consent to isolation in hospital on condition that they may have a certain amount of privacy; and further, it is by no means an uncommon circumstance that patients, on their

first admission, do not exhibit symptoms sufficiently marked to warrant their being placed in wards containing other infectious patients. In certain hospitals where no isolation-wards have been provided such a patient has at times been placed in a ward containing patients suffering from the disease which the new comer is, for the moment, suspected of having; but the result has, in several instances, been, that a disease, under which the patient was not labouring, has been contracted. Not long since, a delirious patient who exhibited an eruption somewhat resembling small-pox was conveyed to the infectious hospital belonging to a sanitary authority in the north; the case was admittedly of a doubtful character, but since the man came from a locality where small-pox was known to have been prevalent, he was, for lack of other accommodation, placed in the ward allotted to that disease. It soon transpired that his delirium was due to mental disease, not to small-pox, and hence after the disinfection of his clothing, he was sent home again. But within a fortnight he was returned to the hospital suffering unmistakably from small-pox, and the attack, which had evidently been contracted during his previous detention there, terminated fatally. That such an occurrence should be possible in a hospital professedly erected for the purpose of protecting the public against the spread of infection, is especially calculated to hinder the work of isolation which is now being increasingly carried out by sanitary authorities, and it is to the need for making provision against such contingencies, as by the erection of special isolation-wards in connexion with hospitals for infectious diseases, that we desire to draw attention; the occasion being the more opportune because a typical example of this sort of hospital provision has just been erected in the metropolis.

The instance we refer to is at The London Fever Hospital. This institution, which during the past twenty years has received within its walls nearly 35,000 cases of infectious fever, formerly received nearly all the metropolitan pauper cases for whom means of isolation were available; but since the erection of the hospitals belonging to the Metropolitan Asylums Board, the social status of the patients has steadily improved, and by far the majority now admitted to the London Fever Hospital are able to make at least some contribution towards the expenses of

their treatment and isolation. The demand for private rooms has also very materially increased. So also, in the earlier history of the hospital, the institution was mainly used for the purposes of the epidemic at the time most prevalent in the metropolis, and it did not often happen that the number of fevers under treatment at any one time was more than could be dealt with in the then existing separate pavilions. But with the increasing desire on the part of the more educated public to secure the earliest possible isolation of cases of infectious diseases occurring in their homes or houses of business, it now not unfrequently happens that cases representing as many as five different infections have to be simultaneously accommodated in such a way as to avoid all risk of the spread of disease from any one ward or room to another. And since some of the cases thus received are isolated attacks, large wards cannot, for obvious reasons, be set apart for their reception. And further, this desire to secure the earliest practicable isolation is found to result in cases being sent to the hospital in so early a stage of their illness that it becomes difficult in the extreme to determine, at the time of their admission, what is the actual nature of their disease, and whether they are in reality suffering from any of the specific fevers. These several circumstances, which must be regarded as applying, more or less, to all hospitals for infectious diseases established in different parts of the country, have led to the determination on the part of the authorities of the London Fever Hospital to provide a building containing a series of isolation rooms, which can be used either as rooms in which patients can be detained during a short period of probation, or as private wards for special cases.

Hitherto, the principal hindrance to the erection of a building adapted to such purposes has been the difficulty of so arranging the several apartments that there shall be no risk of the spread of infection from one to another, and of so designing the internal arrangements of each ward or room that these apartments may be thoroughly cleansed and disinfected after each use for probationary or other purposes. All this has been so satisfactorily overcome in the building which is at present under consideration, and which has been designed and erected under the supervision of Mr. Keith D. Young, architect to the hospital,

that its principal features may with advantage be discussed somewhat in detail. One prominent characteristic of the building is that it stands, as advocated and illustrated in Mr. Paget's paper, on an open-arched half-sunk basement story six feet high, the floor of the basement being formed of concrete and the earth around the building being sloped away at an angle of 30°. The objects here held in view are, to secure a constant movement of air beneath and around all parts of the building, and to provide for the entrance into the wards by means of the ventilating openings just above the floor level, of an air which shall not be derived from a stagnant angle where soil emanations tend to accumulate. This point, together with that of the influence of ground air upon health, has hitherto received more attention abroad than in this country. The wards as yet constructed are three in number, two for two beds each, and one for three beds, the central one being temporarily adapted to the requirements of a nurse, and being fitted with fixed windows commanding a view of the other two. To the front they open separately and by means either of a door or of casement windows into a covered verandah into which a patient's bed can be wheeled, and to the back is an open corridor on the outer side of which is a small projecting building containing the necessary lavatory and other offices. Cross-ventilation is secured by means of windows in the external walls. In view of the varying use to which the wards will be put every effort has been made to avoid all internal arrangements which would in any way favour the retention of infection. Thus, the walls of the wards, corridor, and offices are of glazed brickwork, arranged in different tints, with a view to decorative effect, and presenting a completely impervious surface which can easily be washed down with a disinfecting or other fluid. All internal angles, whether vertical or horizontal, have been formed of curved bricks so as to avoid stagnation of air in corners, and to prevent the accumulation of dust in the angles formed by the walls with the floor; and care has been taken to avoid all recesses or projecting mouldings and square angles, in which dust and dirt usually tend to accumulate. Apart from the casement windows referred to, double-hung sashes, together with a fanlight above, have been provided, and with a view of main-

taining an equable ward temperature the glazing of the windows is of stout sheet glass in two thicknesses with an interspace of three quarters of an inch.

It thus happens that the special features to which we have adverted, being combined with the general principles of hospital construction laid down in Mr. Paget's paper, an exceptionally excellent series of small wards have been designed and constructed; and since, with the increasing use of infectious hospitals in all parts of the country, the grounds on which the London Fever Hospital has found it necessary to make this special class of provision cannot fail sooner or later to apply to most hospitals of a similar character, we take the opportunity of pointing to the great advantage of providing at all infectious hospitals a series of isolation and probationary wards. They will be available for the reception of any ordinary cases, but when not so used they will serve the special purposes which we have enumerated, and for which it is so important that provision should be made.

CONTRIBUTIONS TO A STUDY OF THE CAUSES OF EPIDEMIC DIPHTHERIA.

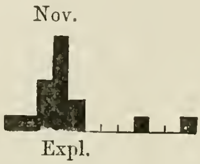
BY ARTHUR DOWNES, M.D.

(*Continued from* p. 471, vol. xxxi.)

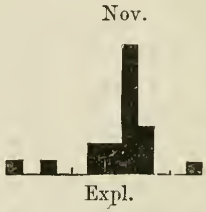
IV.—Diphtheria Explosions.

Familiar to all who have much acquaintance with epidemic diphtheria must be those sudden and localised outbreaks of which I now write. Sometimes heralded by an irregular occurrence of throat-illness, which may or may not be obviously diphtheric, sometimes without such local precursor, these "explosions"—the term which seems best to indicate their rapidity of rise and subsidence—usually happen in late autumn, and commonly centre, in causation, round some village school.

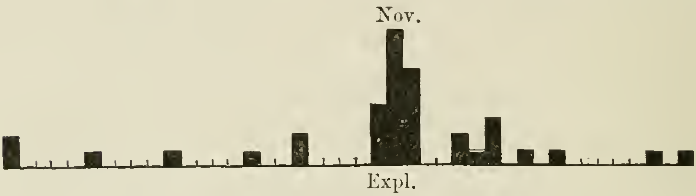
My meaning is best illustrated, perhaps, by the subjoined diagrams of the course of three local epidemics of diphtheria, in each of which an "explosion" occurred, showing the proportionate numbers of fresh houses invaded in successive weeks.



I.—Great Baddow (12 weeks).



II.—Wickham Bishops[1] (12 weeks).



III.—Oaksey (43 weeks; the infection was still lingering some weeks later).

The cause of these local and temporary intensifications of epidemic virulence is a question of high importance and interest, alike in its scientific and practical aspects. To its consideration the present section is devoted.

In three "explosions" of diphtheria, such as I have delineated, I have observed that in causation they were apparently associated with the attacks of one or two individuals. In each instance a child convalescent from an attack of throat-illness[2] has returned to school, and this return has been followed by a diptheric explosion.

Their history is briefly as follows :—

1. On October 2nd, 1880, a boy came to Great Baddow village, on a visit to his uncle, from Billericay—a small town

[1] A solitary case (fatal) occurred six months later. The source of infection was not traceable. In the interval two or three cases of illness, presenting enteric features, had occurred. It is uncertain whether these bore any relation to the diphtheria outbreak.

[2] In two of these explosions this was of slight character not requiring medical aid, and not regarded at the time as diphtheria. In all three explosions, however, I was able to trace what I will term the "evoluting" throat-illness to direct infection from pre-existent diphtheria of typical kind.

eight miles distant—where early in September he had had a slight attack of diphtheria. Dr. Raine, his medical attendant, imformed me that there had been, on September 6th, "a slight film on one tonsil," but that in about four days the boy had been convalescent; he further told me that shortly after this a sister had sickened and had died of diphtheria on September 20th.

At the time the boy arrived at Baddow no diphtheria was there known to exist. Soon after his coming, sore throat appeared in the uncle's family.

Bessie, aged 7, was attacked about October 4th, Edith, aged 11, a few days later. Bessie attended Class III. at the National (Girls) School and is marked as absent, sick, October 4th to 11th inclusive. Edith was a member of Class I. in the same school, and was away on account of sickness October 12th, 13th 19th, 20th, 26th, and 27th.

Between October 20th and November 5th twenty children, all attending the National Schools, sickened with diphtheria of severe kind, and five of them died.

The incidence on various divisions of these schools was as follows:—

		Scholars.	Attacks.	Percentage attacked.
Boys' School		101	2[1]	**2·**
Girls' School Class	I.	18	3	**17·**
" " "	II.	23	nil	nil
" " "	III.	47	10	**21·**
Infant School		66	5[2]	**7·**

No cause of the special incidence on Classes I. and III. (Girls' School) other than the attendance of Bessie and Edith at those classes could be discovered. And the indication that those children were the foci of this explosion is greatly strengthened by the fact that all, or nearly all, the girls attacked (including those in the Infant School, *see foot-note*) were members of a particular school-clique, to which Edith and Bessie belonged, "playing together," as I wrote at the time, "to the exclusion of

[1] In each of these cases the infection was traceable to a source external to the schools.

[2] Four of these were girls. The children composing the infant class sat in one room, but the boys entered by a separate entrance from the girls, and used the elder boys' closets (trough, w.c.), and play-yard, while the girls used the elder girls' play-yard, &c., the two yards being separated by a high brick wall.

others, at kiss-in-the-ring and other games apparently well adapted for transference of diphtheric contagion."

2. Wickham Bishops, an agricultural parish in Essex, had for some years been free from diphtheria.

About the end of September 1881, Miss A. returned to her home, a good class farm-house, from a visit, in the course of which she had, four weeks previously, contracted diphtheria, which had appeared in the house where she was staying. It is stated that previously to her return she had recovered from the diphtheria for about a fortnight. That return, nevertheless, was shortly followed by similar illness of a younger sister.

Early in October Mrs. B., a neighbour and intimate friend of the A.'s, had a sore throat, and towards the end of the same month several of her children suffered—one of them eventually dying of "diphtheric croup." But for the moment these throats were not regarded as diphtheric.

Two of these children aged 8 and 6 attended the village school, being in Class III. and Infant Class respectively, and during their illness continued their attendance with but little intermission.[1]

Between November 11th and 18th sixteen children, all attending the village school, were attacked with diphtheria of a very fatal type.[2] The schools were closed November 14th, and after the 18th only two fresh houses were attacked. The outbreak was strictly limited to this particular school; there were many children in the locality who attended other schools, but they escaped entirely.

Twenty-two children were attacked within four days of their last school attendance, and the incidence on the several classes was as follows:—[3]

Class.	Number of scholars.	Percentage attacked.
III.	20	**25·**
Infant	28	**39·**
Rest of school	37	**16·**

[1] The elder girl is marked absent November 8th only, the younger on November 2nd—5th inclusive. There was considerable swelling of the cervical glands in the latter's case. I have come to attribute some importance to this symptom as an indication of both infectivity and infectiousness of sore throat.

[2] The mortality of this epidemic was 30 per cent. of attacks.

[3] There was not any isolation of one section of this school from another as at Baddow.

The only discoverable sources of contagion common to these children were the two B. children. And that they were the focus of this Wickham explosion seems further to be indicated by the preponderance of incidence on the particular classes attended by them.

3. No diphtheria had been known for three years in the country parish of Oaksey, Wiltshire, and only a single death from any form of throat-illness had ever been registered therein until 1882, when, sequentially to the arrival of a child from Cirencester,[1] the disease became prevalent, and in November culminated in a sharp explosion.

The circumstances of this explosion seemed to be as follows: —During the harvest holidays a lad, Stewart W., aged 4, had sickened with mild diphtheria. On October 11th his family left Oaksey to reside elsewhere, but on October 8th, being convalescent, he had attended a Sunday School at Oaksey Chapel.

Between October 11th and 14th, two children, who had been at that school on the 8th, took diphtheria, of which one of them died. The other, Kate M., aged 7, recovered, after a moderate attack, returned to school on and after October 30th, and formed, as I believe, the focus or "evoluting case" of the explosion which, between November 14th and December 2nd, followed. In nineteen days were attacked as many families.

Kate M. attended two schools—the National School on week days, the Chapel School on Sundays—being in the infant class of the former and the 5th class of the latter.

Taking only primary[2] cases, the incidence of the explosion was as follows:—

School class.	Number of scholars.	Percentage attacked.
National Infant	32	**25·**
„ rest of school	44	**6·**

At the Chapel Sunday School the children were divided into Bible classes of six to eight children each. In the class (V.) to which Kate M. belonged there

[1] The case of this child will be further considered in regard to another question to be discussed in the next section of this paper.

[2] That is, first attacks in a family.

> were, during the explosion, four attacks, and in each of the adjoining classes (IV. and VI.) were two attacks. Taking the children in these three classes as twenty-four in all, the incidence on them would be 33· per cent. attacked. On the remainder of the school (thirty-one in number) there were only two attacks, or 6 per cent.

The greatest incidence was thus on children, and they represent $\frac{17}{19}$ of the families affected by the explosion, who were more especially associated with Kate M. Further evidence of special infectiousness of this child seems to be afforded by the fact that the thirty-two children composing the National School infant class were divisible into two groups: group A consisting of twelve children who were *neighbours and playmates* of Kate M., group B of twenty children coming from other parts of the parish. The incidence on group A was **42·** per cent., on group B only **15·** per cent.[1]

At Oaksey, therefore, we find that $\frac{17}{19}$ of the explosion is represented by the attacks of certain school children divisible into distinct groups, whose only connecting link as school-fellows or as neighbours and playmates, was the presence of the diphtheria-convalescent Kate M.

These explosions are not selected examples; they are the only ones of sufficient extent that I have had the fortune to officially investigate. The evidence I have put forward establishes, I think, a *primâ facie* case in favour of the proposition that *in diphtheria-explosions,*[1] *we should look for a focus in the exceptional infectiousness of a pre-existent individual case of diphtheria.*[2]

Any hypothesis that those groups of children, who especially suffered in the outbreaks which I have recorded, suffered, not through the exceptional infectiousness of a companion, but through some predisposing or exciting cause associated with either air, soil, water, or food, to which they were peculiarly subject, may be at once dismissed. In no case were they in any

[1] That this was not an effect of *locality*, as such, is shown by the fact that, during the same period, among twenty other children of school-going age, also neighbours of Kate M., but *not associated with her* at school or elsewhere, there was not a single case.

[2] Explosions occasioned by infected milk or other indirect media of diffusion being excluded.

such respect differently circumstanced from their school-fellows or neighbours of similar age and social status. Hygienic advantages and disadvantages alike they shared equally with others certainly not less numerous than themselves.

It may be objected to the proposition above laid down, that the infection, introduced originally, it is granted, to the special group by some individual member, may have been passed on by other members in a species of geometrical increase.[1] To this objection may be opposed the fact that in each of the outbreaks which I have recorded the children were kept from school as soon as, or very shortly after, they were attacked, nor did they return in any case, as far as I have been able to ascertain by careful inquiry, until long after the subsidence of the explosion. It is partly met, too, in the case of Wickham Bishops at least, by the short duration of the explosion-period.

Evidence against it, and certainly strong evidence against the suggestion of a *general* progressive infectiousness, seems also to be afforded by the remarkable fact that the cases occurring during the explosions, possessed, as a whole, no higher spreading power than that found by Dr. Thorne Thorne in the Coggeshall epidemic (see p. 470, vol. xxxi.) ; for, following in each outbreak the infected children to their homes, I found that in not less than 50 per cent. there was no extension whatever of infection to their relatives. Indeed, excluding secondary cases of children who had been at school within four days of their attack, the proportion of homes in which no extension of infection occurred was 63 per cent.

I have notes, too, of the age-distribution of the families of fifty-two of the children attacked in these explosions, and although in the cottage-homes of these children were fifty-seven others, of similar age, freely exposed for many days or even weeks to such infection as existed, sometimes actually sleeping with their sick brothers and sisters, I find that of the fifty-seven only nine—or 15 per cent.[2]—showed the slightest symptoms of diphtheria.

[1] Associated, it might be, with a progressive intensity of the contagium itself.

[2] Compare the incidence, 38 per cent. on ages 3—12 in Table V. p. 400, vol. xxxi. The proportion of attacks on these 57 children would appear to have been greatly *below* the average.

It would seem, therefore, that in the examples which I have given, so far from possessing evidence of progressive intensity of infectious virulence or even of simple geometrical extension of that infection, as suggested above, we have a distinct indication that the activity of the *contagium* may be and was reduced by a single remove; insomuch that an infection, which previously had involved 20·, 40·, or even 50· per cent. of children exposed to its influence at intervals of comparatively brief duration, now fails to attack more than 15· per cent. of those living in its presence day and night, for days and weeks together.

Thus, the view that the mere opening up of a new field of spread by the invasion of a school, or particular group of school-children, is in itself sufficient to account for an explosive outbreak of diphtheria without necessitating any supposition of exceptional infectiousness of an individual is not supported by the facts above set forth, which distinctly show that, in the instances given, the infection did possess, as compared with its subsequent behaviour, a very exceptional potency.

My experience, indeed, is that the attendance at school of children with throat-illness, which is essentially diphtheria, or of convalescents from such throat-illness, is by no means commonly followed by any explosive outbreak. I have repeatedly seen, contemporaneously with a severe outbreak in one parish, the appearance of diphtheric children at school in the next parish succeeded merely by a few cases at irregular intervals.

It is my belief that, although the occurrences of diphtheria which most attract public attention and create public alarm are those explosions which I have endeavoured to delineate, their production is comparatively exceptional. What I commonly see in my own districts, which are rarely if ever wholly free from the disease, is a persistence for a time in this or that locality of throat affections, not obviously diphtheric in each case or even in the majority, marking its progress now and again by symptoms of less uncertain kind.

Be this as it may, I think that I have advanced *primâ facie* evidence of an important bearing of that variation of diphtheric infectiousness on which I laid stress in the preceding section of this paper. Whether, as I suggest, a special

development of virulence is found to be associated with a particular individual, future experience must determine. If my suspicion is justified it will remain for us to isolate if we can the conditions which lead up to that development. Until then it would be premature to speculate further on this question, but before dismissing it I would note the possible bearing upon it of that progressive development of infectious virulence disclosed by the researches of Burdon-Sanderson,[1] of the modifications in contagion said to be attainable under cultivation by the methods of Pasteur and others, and of that acquirement of virulence at periods of the life history of a *contagium*, which yet later experiments indicate.

At the same time, in suggesting this explanation of local intensifications of diphtheric virulence, I do not lose sight of the fact that there must be at work factors yet more subtle and far-reaching, factors of which our knowledge is summed up by the convenience of some such phrase as "epidemic constitution" or "*genius anni*," and of which the interpretation, were it forthcoming, would probably be found to cover the whole domain of life. We must not confound the local outbreak with the epidemic or pandemic wave; the one may be compared to the far-reaching billow, the other to a ripple on its surface.[2]

V.—Late Infectiousness in Diphtheria.

In this section I wish to bring under notice another point of considerable practical importance which may have already attracted the reader's attention. It happens that each of the three outbreaks which I have described was apparently initiated[3]

[1] A bearing already suggested in these pages, but from a somewhat different point of view (Dr. Thorne Thorne, "Origin of Infection," *Practitioner*, June 1878).

[2] I do not intend in this paper to touch upon questions of climate and season in relation to diphtheria, but it is worthy of note that each of the "explosions" above recorded was associated with excessive rainfall.

[3] I am referring to the cases of the boy from Billericay in the Baddow outbreak, of Miss A. at Wickham Bishops, and of Carry T. at Oaksey. It may be interesting to mention, as an illustration of the difficulty which frequently attends the investigation of the origin of a diphtheric outbreak, that not until the spring of 1883 did I obtain full evidence of what I now believe to have been the source of the Wickham epidemic in 1881.

by a person whose attack—in neither instance severe—had commenced so long previously as a month or even six or seven weeks.

As an example I may refer to the case of the child, Carry T., from Cirencester, which, to all appearances, furnished the starting-point of the diphtheria at Oaksey.

She habitually attended Cirencester Board School, but ceased to do so on and after May 2nd on account of a sore-throat, which had commenced between April 25th and May 1st.[1] This sore-throat was of mild character, she was only seen thrice by a medical man, and nothing indicative of diphtheria was noted by him. On May 22nd she was sent to her grand-parents at Oaksey to recruit. On her arrival, or soon after, it was noticed by several persons that her voice was peculiar, "just like some of the children who had had diphtheria." She had difficulty in swallowing, so that "bits of food stopped in her throat," and her sight was defective. On June 10th, nineteen days after Carry's arrival at Oaksey, Emily S.,[2] aged 3, living with the same grand-parents, and Wilfred S., aged 5, living at their son's next door, sickened with diphtheria, of which the latter child died. Neither had attended any school, nor had been exposed to any known source of diphtheric infection other than Carry T. Three brothers and sisters of the latter living at Cirencester are said not to have suffered, although they had been in no way isolated. This fact, together with the long interval between her arrival at Oaksey and the attacks (simultaneous be it noted) of Emily and Wilfred S., indicates, I think, that the quality of infectiousness did not attach itself to her throat-illness until a late stage of convalescence, or that the *contagium* was not readily transferable in the earlier periods. It is true that a long interval between one case of a disease, having usually an incubation period of a few days only, and those in sequence to it suggests the possibility that the infection may have been conveyed indirectly by fomites or by some other medium.

[1] The aunt at Oaksey thought that Carry T. had only been ill for about a week before she came. The date in the text, however, is from the mother's and the child's own statements, confirmed by reference to the school attendance register.

[2] This child had shared the same room, but not the same bed, as Carry ever since the latter's arrival. That the latter was far from well when she came to Oaksey is shown by the fact that for a week or more she was kept indoors.

As regards fomites, I am not in a position to exclude the possibility by positive evidence, for the simple reason that the subjects of my observations were invariably accompanied by clothes which might have been exposed to infection, but regarding disinfection of which I could not add any evidence of my own to confirm assurances given to me from interested sources. But it has always appeared to me notable that we do not possess more evidence of the spread of diphtheria in this way,[1] and from the absence of such evidence I should infer that this mode of dissemination is rare—too rare to justify us in employing it in explanation of cases so common as I believe the present to be. For, from my note-books and from other sources, I could give many additional examples of this late infectiousness, or delayed transmission, of diphtheria.[2]

I had no difficulty, however, in excluding the possibility of influence of media other than fomites, in regard to several cases which I observed in the Oaksey epidemic.

The balance of evidence stands therefore in favour, I think, of the not infrequent existence of *personal* infectiousness, so late as six weeks and possibly later, after an attack of diphtheria of trivial character.

But whether the infection be conveyed directly or indirectly, the practical conclusion to be drawn, is, that cases of throat-illness, not obviously diphtheria, must not be too lightly regarded, that all throat-illness in children should be isolated, and that

[1] I have lately seen in the practice of my friend Mr. Salter, of Tolleshunt D'Arcy, a remarkable case of apparent transmission of diphtheria by fomites. Mr. Salter has recorded the facts in the *British Medical Journal* of December 1, 1883.

[2] When I first observed what I have termed late infectiousness in diphtheria, I was not aware that the point had not escaped the notice of Dr. W. Squire, who, in his paper on the "Period of Infection in Epidemic Disease," *Trans. Epidemiological Society*, states that—"in diphtheria, as in scarlet fever, the infection may be more active at certain stages of convalescence than at others;" he refers to some cases of Sir W. Jenner's in which the infection seemed most potent in the fourth or fifth week, and asserts that "cases in the *System of Medicine* (Reynolds) abundantly prove the persistence of *personal* infectiousness for four to six weeks." The italics are mine. Dr. Thursfield recently narrated to me a good case in which the infectiousness of diphtheria survived six weeks after attack. Partial, but, so far as it goes, corroborative testimony of late infectiousness is afforded by the long interval which often intervenes between successive cases in a family. I have many examples in my note-books. See also Sanderson in *Rep. M. O. Privy Council*, ii. p. 255.

if there is any ground for supposing that such illness is of diphtheric kind—whether membrane be observed or no—the isolation should be prolonged.

For how long? This is a difficult question to answer in the absence of definite knowledge of any symptoms from which infectiousness might be inferred. I should say that no child should return to school who has remaining any traces whatever of unhealed throat-illness, any recent enlargement of lymphatic glands in the cervical region, or any indication of disordered innervation or paralytic sequelæ.

In advancing this evidence of late infectiousness in diphtheria I do not ignore facts which indicate that this disease may be communicable from a very early stage. In this the parallelism with scarlet fever holds good, and I think that Dr. W. Squire's opinion in respect of scarlet fever, that infection, though present, is less intense during the first day or two than it becomes at a subsequent period, may be applied to diphtheria.[1] In either disease healthy children, who have been in contact with an infected child during the initial stage, may be removed with reasonable expectation of their escape.

VI. Recurrences of Diphtheria.

Recurrences of diphtheria may be of two kinds, recurrences in regard to geographical locality, and recurrences of attacks in the individual. The present article refers more particularly to the latter.[2]

[1] See Dr. Squire's valuable papers on "The Period of Infection in Epidemic Disease," in *Trans. Epidemiological Society.* In reference to possible cases of *early* infection he mentions the case of a boy attending school from an infected house, whose attendance was stopped on the first appearence of symptoms, but who had already, it would seem, infected a number of other children in the school. Some years ago I investigated a case where a female servant from a farm-house, in a locality believed to be free from throat-illness, slept for two nights at her home, about five miles distant. There was diphtheria in her family at the time, and next day, immediately on her return to the farm, she developed a smart attack; within twenty-four hours of this the farmer's son was also attacked. No other source of his illness than infection from the girl herself or conveyed by her clothes could be discovered. Dr. Squire's warning, that apparently healthy children from infected houses may either carry infection about them, or, having the first processes of the disease already set up in themselves, may diffuse it widely before it is known to have commenced, is a very practical one.

[2] The incidence of diphtheria on certain districts, and its local recurrence is a very interesting and important study, which, in a paper already exceeding its limits, I

Of recurrences in the individual, I have experience of two classes, the one occurring in the course of true epidemic diphtheria, the other related to a sporadic membranous sore-throat to which I shall briefly refer below.

Recurrent attacks in the course of epidemic diphtheria are common enough. I have notes of such, occurring at intervals varying from a fortnight to ten months. A list of similar cases is recorded by Dr. Burdon Sanderson,[1] and they are mentioned by other writers. It has been noted[2] that these second attacks are usually more severe than the first. This accords with my experience; but I am not able to produce evidence bearing on Dr. Squire's suggestion[3] that some relapses may be, as in whooping-cough, non-infectious.

Twice within the last few years I have seen a slight attack of diphtheria followed a few months later by fatal "croup." In another case during the present year (1883), the relapse (with paralysis) dated from the first outdoor appearance of the little convalescent on February 23rd, after an attack commencing January 18th. In September 1882, this child had had sore throat coincidently with a diphtheric outbreak in his school, but there was no obvious source of re-infection in January. Jacobi[4] has suggested, as an explanation of these recurrences, that in the enlarged glands the diphtheric contagium is stowed away for occasional resuscitation as we know it to be, for example, in syphilis. I see nothing improbable in this suggestion; indeed, long before I saw Dr. Jacobi's paper, the hypothesis had presented itself to my mind. It seems to me a greater difficulty to understand why the contagium should not more often linger and recur.

must not take up. I may, however, mention that one of the earliest recorded instances of a recurrent attack in an individual with which I am acquainted, occurre in a locality well known to me as a special diphtheric field. Dr. Wall, of Worcester, mentions (in *The Gentleman's Magazine*, November 1751) the case of a gentleman at Ludlow in Shropshire, who took what was undoubtedly this disease from his wife, and had a recurrence of it. At Ludlow, in January, 1851, occurred the earliest case yet known to me registered in this country as "diphtheria" or "diphtherite." During the decade 1851—60, the same district suffered severely from "malignant sore throat," and in 1875—6 I myself had cognisance of a terrible visitation of diphtheria in that locality.

[1] *Loc. cit.* [2] Sanderson, *ib.* [3] *Loc. cit.*

[4] *Transactions of the Medical Congress*, London, 1881.

The recurrences of sporadic "diphtheria" to which I alluded do not strictly fall within the scope of this paper, inasmuch as the throat-illness in this case is not epidemic, and, so far as my own experience goes, has not been proved to be true diphtheria. In this class of cases the inmates of a particular house, or a special group of them, suffer again and again from a depressing form of sore-throat, often membranous and requiring stimulant and tonic treatment. The cause is evidently local to the house; away from home the family not only do not suffer, but their general health is markedly improved by the change. Cases of this sort are, in my experience, invariably associated with gross sanitary shortcomings. In a case[1] where a carpenter's family had been for years attacked, more often than they could remember, it was found that part of the cottage was built on the site of some old privy cesspits from which the soil had never been properly removed. Since this discovery and the consequent remedy, now nearly three years since, two children only have had a recurrence. During the previous thirteen years it is stated that scarcely two months ever elapsed without an attack of "quinsy" or "diphtheria." I have a similar instance now under observation. My hesitation to class these membranous sore-throats with the diphtheria to which the previous portions of my paper related is due to the fact that so far I have not seen any spread of them beyond the limits of the infected house, nor have any of the cases been followed by paralytic sequelæ.

In part they may serve to reconcile the divergent opinions of those to whom the relation of filth to diphtheria is a thing unknown, and of those who would apply to every outbreak the *cherchez la femme* doctrine of "where is the nuisance?"

[1] Recorded in my Annual Reports (Chelmsford R. S. D.) 1880-1-2.

ERRATA, VOL. XXXI.

Page 397, Table I.—Last line, *for* 566 *read* 56·6.

Page 400, Table V.—20 persons with 9 attacks were inadvertently included with age-group 3—12 instead of 0—3. The percentages attacked therefore should be **38** in the first, and **19** in the last-named group, the incidence of the former being twice, not thrice that in the latter.

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Original Communications.

HISTOLOGICAL LESIONS OF THE KIDNEY IN ALBUMINOUS NEPHRITIS.

BY DR. V. CORNIL,

Professor of Pathological Anatomy to the Faculty of Medicine of Paris.

(*Continued from* p. 13.)

Chronic Forms of Permanent Nephritis—Large White Kidney.—Let us now look at the chronic forms of permanent nephritis. We have generally here to do with what is called the large white kidney, or the large soft kidney. This diseased condition may be observed in consequence of syphilis, alcoholism, exposure to cold, and sometimes also in tuberculosis. The kidney is larger than normal, but this enlargement presents many variations; it may be sometimes hardly preceptible at other times both the size and weight of the organ may be double the normal. Its colour is sometimes white, but more frequently yellowish-white. Its consistence is pasty or flaccid. On section the yellowish-white colour is seen to belong exclusively to the cortical substance, and contrasts sharply with the red colour of the medullary substance. The enlargement of the kidney is then seen also to be almost entirely due to thickening of the

cortical substance. Sometimes in this form of Bright's disease phlebitis of the renal vein is met with. This occurrence has been noted three times in Rayer's observations, and we have observed it ourselves this year. Under the microscope the convoluted tubules exhibit the cellular lesions already described: a vesicular condition of the cells, with globules, and exudation into the lumen of the tubules. The chief characteristic of this form of disease, however, is fatty degeneration, which is much more considerable than in the other varieties we have hitherto studied. This degeneration is very irregularly distributed. The cells are sometimes completely degenerated, and occasionally quite detached from the wall of the tubules, but generally the cells remain in their place and there is no epithelial desquamation in the sense that Johnson employs the term in reference to this lesion, which he has denominated desquamative nephritis. In fact, even if some epithelial cells fall off, the wall of the tube is not on this account laid bare, for new cells form which remain attached to the wall, and replace those which have desquamated and been carried away by the urine.

In the glomeruli, besides the lesions already described, we sometimes observe endothelial cells undergoing fatty degeneration, and a similar degeneration of the cells situated on the surface of the glomerular loops.

The connective tissue of the kidney may also undergo this degeneration, so that we may see fine fatty granules in the connective tissue bundles lying between the renal tubules. These fatty granules are situated in the protoplasm of the cells of the connective tissue, or between the bundles of this tissue, or around the capillary vessels.

In addition to this we almost always find the lesions of interstitial nephritis in the large white kidney, *i.e.* infiltration of round cells between the vascular loops of the glomeruli along the vessels. In the large white kidney it rarely happens that some of the glomeruli are not transformed into a little lump of connective tissue completely impermeable to blood. These glomeruli are then atrophied and devoid of function.

Amyloid Degeneration.—The large white kidney may perhaps be confounded on simple examination by the naked eye with

the amyloid kidney, which often presents the same volume and the same aspect. A knowledge of the causes of the disease does not help us to diagnose between them, for an amyloid kidney may, like a large white kidney, be consequent on syphilis, scrofula, or tuberculosis. On examining, however, a section of the amyloid kidney we often see a translucent condition of the glomeruli which is quite special, and which makes us think of amyloid degeneration. We must, however, to a certain extent mistrust this appearance, for in certain white kidneys an intense subacute glomerulitis occurs with increase in volume of the glomeruli, which then have become semi-transparent. There is one means, however, of diagnosing with certainty, and this is by pouring a solution of iodine on the kidney and seeing if the glomeruli and the walls of the arterioles become stained. When sections are treated with a weak solution of iodine, all the parts which have become transparent and hyaline, in consequence of amyloid degeneration, are stained brown by the iodine and are coloured red when sections are treated in a similar way with methyl-aniline violet. These parts are the vascular walls of the glomerular loops, in whole or part the walls of the afferent arterioles, the membrana propria of the tubules and of the glomeruli, and sometimes even bundles of the connective tissue of the kidney. After staining by iodine they sometimes take on a green, orange, or blue colour on the subsequent application of sulphuric acid. The effect of this transformation of the vascular membranes is to thicken them to a considerable extent, so that the lumen of the vessels becomes progressively smaller, and is finally obstructed altogether. The blood can then no longer pass into a certain number of the glomeruli, and the kidney is always anæmic. The consequences of this are albuminuria, granulo-fatty degeneration of the epithelial cells, and frequently grave symptoms of uræmia from the retention in the blood of the waste products which would be eliminated by the normal kidney.

The concomitant lesions of the epithelium—the vesicular and granulo-fatty conditions, the mucous and colloid secretions, the hyaline casts which obstruct the loops of Henle and the straight tubules—all the lesions are the same as in the other

forms of albuminous nephritis which we have just been studying. Amyloid degeneration is, in fact, nothing but Bright's disease complicated by a special alteration of the vessels and of the membranes.

An exception must, however, be made in certain cases of local amyloid degeneration of the kidney affecting only the vasa recta of the medullary substance, and affecting only very partially the Malpighian capsules. In these cases the lesions of the cells are absent. M. Litten [1] has published a certain number of such cases, and M. Strauss [2] has insisted upon the absence of albuminuria in them.

Amyloid degeneration sometimes accompanies interstitial nephritis, with atrophy of the kidney and formation of colloidal cysts. Thus we shall soon have to recur to it again when we have studied this form of nephritis.

Large white granular Kidney.—I now come to the description of the large white granular kidney, called by Rayer *Bright's granular kidney* (*rein avec granulations de Bright*).

To the naked eye this kidney presents on its surface yellowish-white spots, and often grains or granulations of the same colour, opaque and distinctly projecting. The size of these grains varies; they are sometimes as large as a millet seed or pin's head, generally they are larger, but sometimes they are much smaller. The substance which surrounds these granulations is sometimes quite different from them in colour, being rosy or reddish; this zone indicates peripheral congestion. The veins of the cortical substance (stellæ of Verheyen) are generally distended with blood. These granulations are not regularly rounded or spherical; they are prolonged into the cortical substance, and on section we find them presenting the form of small yellowish-white pyramids the edges of which pass gradually into the neighbouring parenchyma. When we examine these granulations under the microscope, we see they are formed of tubules which have preserved their normal diameter or are dilated, while the tubules which surround them are atrophied. The lumen of these tubules is greater than normal; they are filled with fatty

[1] "Zur Lehre von der amyloïden Entartung der Nieren" (*Berliner klinische Wochens. chr.* Nos. 22 and 23, 1878).

[2] *Société médicale des Hôpitaux* (10 June, 1881).

cells, or with cellular débris and with true granulation corpuscles. The investing cells of the tubules are largely developed, and they contain large fatty drops.

The granulation formed at the expense of the pyramid of Ferrein projects at the surface. It is the base of this pyramid which is the habitual seat of this kind of transformation.

On making a transverse section of such a kidney parallel to the surface we find somewhat voluminous contorted tubules in the middle of the little granulation, and around it uriniferous tubules which are distinctly smaller, having only about one-third or one-fourth of the normal volume. The tubules in the periphery of the granulations are surrounded by tolerably thick bands of connective tissue. In this periphery we find tolerably numerous glomeruli. These are atrophied as well as the convoluted tubules which pass from them. These lesions form the commencement of interstitial nephritis. They explain the formation of granulations, and they help to exaggerate the projections of the granulations on the surface of the kidney when the newly-formed connective tissue retracts.

As I have said, the granulations are opaque because they are generally fatty, but it must be remembered that the cellular degeneration is variable, and if the cells are but little altered, or are simply vesicular, the granulations may be transparent, and this they sometimes are. Such are the lesions which we find in the large white granular kidney, but I must add that in the chronic forms of Bright's disease we tolerably frequently find granular kidneys which are diminished in size.

I must now say a word about the white kidneys which are enlarged, or of ordinary size, but without granulations. The first variety of these occurs in cases of phthisis, where, on post-mortem examination, we find the kidneys altered, opaque, whitish, greyish, or yellowish, without granulations on the surface. There is generally little albumen in the urine in such cases.

A second variety is observed in diabetics, in whom there may or may not have been albuminuria during life. The fact is that albuminuria in diabetics is ordinarily slight.

The lesion that is found in certain diabetics consists simply in a granular fatty degeneration of the epithelial cells of the tubules. The cells are normal in volume or hypertrophied,

and present at their attached base a regular line of fatty granules. Sometimes proliferation of the nuclei is found in the cells.

These lesions sometimes exist, as I have just said, in certain cases of diabetes where no albumen occurs in the urine ; when there is albuminuria these lesions are more developed.

A third variety occurs in the gouty. Generally these patients have albuminuria in the cachetic period of gout ; and this last period may be complicated or not with cardiac affections or with diabetes.

During the evolution of the gout, except at this terminal period, the albuminuria is subject to remissions and intermissions which may last a variable time.

In all these cases of gouty albuminuria the kidney is modified in a very varying fashion. Sometimes it is small and granular; sometimes it is large and with Bright's granulations; sometimes it is small, white, and soft.

These characters are not at all constant; there is only one alteration special to gout, and this is the presence of tophaceous concretions at the lower part of the pyramid and of the cones of Malpighi. These concretions occur as whitish lines, opaque and brilliant; they are formed of urate of sodium. It is rarer to meet with such concretions in the cortical substance.

In these white lines we find extremely fine elongated and acicular crystals, highly refractive and closely applied to one another. It is the accumulation of these little crystals which gives their characteristic aspect to the extremity of the cones. If we treat these little masses with acetic acid, or weak hydrochloric acid, they are transformed into uric acid, and we are then able to ascertain that the crystalline deposit occupies the cells and fibres of the intertubular connective tissue, as well as the cells and lumen of the straight tubules. The deposit formed in the interior of the tubules is generally amorphous. Rayer has described deposits of crystals of uric acid adherent to the substance of the kidney, and formed spontaneously in the parenchyma. These deposits appear as yellowish or reddish bodies, hard and varying in size.

We have now finished the study of the varieties of parenchymatous nephritis, and we can conclude that it is far from being always developed in the same fashion. Its variations depend on the causes which produce it, and the particular duration of each case.

We have already seen that in the purest types of parenchymatous nephritis, we almost always find well-marked lesions of the connective tissue, and in particular of the glomeruli (subacute or chronic glomerulitis terminating in fibroid atrophy, thickening of Bowman's membranes, and of the membranes of the tubules).

Nevertheless there are cases in which the lesions affect the epithelium exclusively, and these may occur even in gout, which is generally considered to be one of the most frequent causes of the small contracted kidney. In fact, three years ago I published a case of gouty nephritis, in which the cellular lesions were well developed and the connective tissue not appreciably affected.

IV.

Interstitial Nephritis.

We have hitherto studied the series of forms of parenchymatous nephritis, acute or chronic, from that of scarlatina to the large white kidney and the forms of nephritis with Bright's granulations, in which the essential lesions affect the epithelium of the uriniferous tubules, but in which the connective tissue in the vascular walls also takes part in the inflammation.

Such for example is glomerulitis, an alteration which is important from an anatomo-pathological and clinical point of view, either in the acute, subacute, or chronic stage, and which we constantly meet with more or less markedly in albuminous nephritis, whether parenchymatous or diffuse. But it is of another group of forms of nephritis that we must now speak, which are characterised essentially by subacute or chronic inflammation of the connective tissue of the kidney. These are forms of interstitial nephritis. Two varieties of them are distinguished: those which form the one variety are accompanied by a quantity of albumen in the urine more or less large, they belong to

albuminous nephritis, to classic Bright's disease; those of the other variety do not cause albuminuria, and are especially met with in the aged along with chronic arteritis of the branches of the renal artery and general atheroma. We will only study here interstitial albuminous nephritis, a sort of renal cirrhosis which ends in atrophy with the production of granulations in the cortical substance, the small red granular and contracted kidney.

Experimental Interstitial Nephritis.—Before entering on the anatomo-pathological description of this nephritis as observed in man, I must give an account of interstitial nephritis produced artificially in animals. Experimental pathology is in fact the basis upon which we always rest as much as possible.

MM. Charcot and Gombault have produced the most marked interstitial nephritis in guinea-pigs by chronic poisoning with carbonate of lead mixed with their food, and especially with bran.

When we examine with the naked eye the kidney of an animal poisoned in this manner, we see that its colour is pale, its surface is studded with depressions and with isolated and projecting granulations, its fibrous capsule is thickened and adherent, and on removing it a thin irregular layer of the cortical substance is torn off along with it. On section we see that the cortical substance is much atrophied, and often contains cysts visible to the naked eye. On microscopic examination we find that the glomeruli are atrophied and exhibit on their surface a thickened capsule, which is itself surrounded at its periphery by concentric *lamellæ* of connective tissue with round cells between them. The vascular loops of the glomerular tuft are separated and compressed by embryonic connective tissue. This newly formed connective tissue is developed indeed especially around the glomerular vessels on the one hand, and on the other around the vessels which pass to the glomeruli and particularly those of the labyrinth. In consequence of this, atrophy of the convoluted tubules takes place at this level: and this is the mechanism of the formation of the granulations which we have just mentioned. These granulations are in fact due to the uriniferous tubules which occupy their centre possessing their normal volume, or even being dilated, while those which are of the

periphery and which correspond to the seat of the enlarged connective tissue formation are atrophied, as well as the majority of the glomeruli.

We have here then a veritable interstitial nephritis. But at the same time we find the epithelial lesions already described, and to which we will not return. To what is this saturnine nephritis due? From the results of microscopic examination, it is probably produced by calcareous deposits, by minute true calculi deposited in Henle's loops. These calculi, which can be easily studied in sections of the kidney, block up a certain number of the loops, and consequently interfere with the excretion of urine. They produce a chronic irritation of the whole segment of the uriniferous tubules above them, that is to say of the convoluted tubules and of the glomeruli. This leads to subacute inflammatory conditions of the connective tissue surrounding the glomeruli and the uriniferous tubules of the cortical substance, atrophy of certain tubules, and dilatation of a certain number of them. Quite recently I have examined the kidney of a rabbit which M. Gombault had kept from the commencement of his experiments with M. Charcot, that is to say, for several years. This rabbit was fat and very healthy in appearance, although it had a certain quantity of carbonate of lead constantly mixed with its food. It was killed in order to examine its kidneys. These were rather enlarged than atrophied, slightly granular, and the surface was marbled with white and rose colour. On section the cortical substance was found to be a little pale; all the tissue of the organ was manifestly indurated. Microscopic sections exhibited a perfect type of interstitial nephritis; the uriniferous tubules and glomeruli, atrophied at the periphery of the granulations, preserving their normal volume or dilated at the centre of the granulations; the thickened connective tissue containing round or ovoid cells in large quantity around the glomeruli and in the vessels, &c. Small calculi in the tubes and loops of Henle were also to be seen,and lesions affecting the epithelial cells of certain tubules, granulo-fatty condition of the cylinders, &c.

We have then in this form of poisoning by lead an excellent example of interstitial nephritis, beginning by a lesion in the interior of the tubules. We might say that we have here a

complete total nephritis, or as some others would call it, a mixed nephritis.

Another example of experimental interstitial nephritis I owe also to the kindness of MM. Charcot and Gombault.

In consequence of *ligature of the ureters* in the rabbit or the guinea-pig an interstitial nephritis is observed which is often accompanied by the formation of cysts in the kidney. We can easily understand the mechanism of the production of these cysts by the retention of the urine which continues to be secreted. The result is indeed a dilatation of the collecting tubules, of the large branches of Henle's loops,—a dilatation which extends into the pyramids of Ferrein and into the labyrinth. A thickening and a dilatation of Bowman's capsule then occurs, the glomerular tuft remains almost normal, and these cysts, more or less numerous and voluminous, are formed.

I have myself obtained from a dog in which I had tied the ureters, tolerably voluminous cysts visible to the naked eye, from one to two millimetres in diameter, and formed by a dilatation of Bowman's capsule.

The convoluted tubules which ended in the cysts could be perfectly well traced into them and were themselves much dilated.

Along with the cysts the lesions of interstitial nephritis are produced by ligature of the ureter, and atrophy of the tubules situated in the newly formed connective tissue often results, so that the distended glomeruli almost touch one another. These forms of experimental interstitial nephritis consequent on lead poisoning and on ligature of the ureter are certainly most characteristic. Their mode of action is almost the same, and we may say that in both cases it is traumatic, for lead may be said to act mechanically by obstructing the straight tubules with calcareous infarcts.

(*To be continued.*)

QUANTITATIVE ESTIMATION OF ALBUMEN.

BY GEORGE OLIVER, M.D. LOND., M.R.C.P.

I THINK it will be admitted by most practitioners that we are much in need of some ready method by which the quantity of albumen appearing in the urine may be accurately determined in the course of clinical work: for, of all the procedures at present known, there is not one that is at the same time ready, portable, and exact—or sufficiently exact to meet the requirements of advancing pathology and practice. Inasmuch as it is unnecessary for me to substantiate this obvious position by pointing out seriatim the shortcomings of the methods hitherto practised compared with our ideal of what a clinical quantitative method for albumen should be, I will at once describe the facts which I wish to adduce in this communication in support of a ready mode of determination, which I have found very convenient, not only at home but at the bedside.

When, twelve months ago,[1] I introduced to the notice of the profession a series of test-papers (potassio-mercuric iodide, potassium ferrocyanide, sodium tungstate, and picric acid) for the clinical detection of albumen in the urine, I suspected they might open the way to some improved mode of quantitative estimation; and this surmise has been confirmed by subsequent observations—for the test-papers have suggested to me several simple and promising procedures: but I will here describe only one of them, because it appears to me to surpass the others in the desirable working qualities of simplicity, quickness, and accuracy.

I determined to take, as the starting-point of the observations,

[1] See *The Lancet*, January 27th and February 3rd, 1883.

a solution of pure[1] serum-albumen. I accordingly dissolved the latter (prepared from blood-serum) by the aid of liq. potassæ. I found that when the test-papers were dropped into such a solution of known percentage of albumen, and when thereby all the albumen was precipitated, the density of the opacity produced varied with the precipitant: being greater, for example, with the potassio-mercuric iodide than with the ferrocyanide. This fact was best shown by viewing printed matter through the milky fluid contained in flattened tubes of uniform thickness, when it was seen that the different turbidities induced proportionate degrees of blurring of the letters. The test-papers, however, caused an equal amount of opacity when a certain percentage of albumen was presented to each kind: *e.g.*—

$\frac{1}{10}$ per cent. to the potassio-mercuric iodide,
$\frac{1}{10}$ per cent. „ „ picric acid,
$\frac{1}{8}$ per cent. „ „ potassium ferrocyanide,
$\frac{1}{6}$ per cent. „ „ sodium tungstate.

I then selected this uniform opacity—representing these several percentages of albumen with the different test-papers—as the standard by which to estimate unknown quantities. Inasmuch as the albuminous precipitate is perishable, it was, of course, necessary to find some permanent substitute before it could be made available for quantitative determinations. I found three ways open to this end.

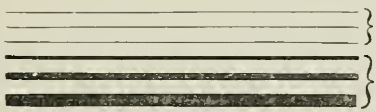
1. In the first instance, I discovered that the standard percentage of opacity could be exactly imitated by precipitating hydrated alumina by means of ammonia from chemically pure alum. I found the opacities so similar that, when freely shaken, and placed side by side, the eye could not distinguish between the two. Besides this, the aluminous precipitate presented a great advantage over other similar opacities in keeping up uniformly diffused for at least from five to ten minutes—leaving ample time for careful comparison during the estimations.

2. I found the aluminous opacity could also be preserved in the less fragile and more compact form of a piece of opaque glass possessing exactly the required degree of opaqueness.

3. Lastly, on viewing printed lines of different thicknesses through the albuminous opacity contained in a test-tube of a

[1] Pure here means "as pure as can be obtained."

determined diameter, it was not difficult to discover a fine line that was only just visible, but on slightly increasing the opacity, passed completely out of view. For example, it was found that the selected line discernible through the opacity produced by the mercuric test-paper, representing one-tenth per cent. of albumen, became quite obscured when one-ninth per cent. was precipitated. In other words—a test-tube of the same diameter being always used—a printed line was found that was invisible by any light until the albuminous opacity was reduced to that of the standard, which therefore became the limit of visibility.[1] On placing the albuminous opacity or the opaque glass over this fine printed line, it became as dimly visible as when covered by the standard opacity. Further observation showed that certain thick lines were only brought into view when the opacity was double that of the standard. The printed lines subjoined, therefore, represent two ranges of quantity for the estimations: *e.g.* with the potassio-mercuric iodide test-paper, ·1 and ·2 per cent.



= ·1 p.c.

= ·2 p.c.

Being now in possession of certain guides—the alumina opacity, the opaque glass, and the paper on which the lines are printed—the observer will find no difficulty in quickly determining the amount of albumen; for he only requires to pour a measured portion of the urine into the test-tube of the prescribed shape and thickness (see p. 94), to precipitate all the albumen by one of the test-papers, and then, when the opacity produced exceeds the limit provided by either of the permanent standards (alumina opacity, or the opaque glass, or

[1] A mode of analysis by which the depth of turbidities (and hence the amount of the materials precipitated) is estimated by the vanishing point of a black or coloured disc in a suitably contrived apparatus (such as Mill's Colorimeter) is already recognised. The method I am following is merely the reverse of this: for the distance of the index is kept uniform, while the opacity is reduced by dilution until the point of visibility is reached. This arrangement conduces so much to simplicity both of the apparatus as well as of the use of it, that I am induced to extend its application to the estimation of some other urinary constituents.

merely the printed lines), to add water until the standard percentage of albumen can be recorded. The data are merely, (1) the number of times the volume of the urine has been increased by dilution, and (2) the known value of the standard according to the test-paper used; and it is only necessary to multiply them together.

The Selection of the Precipitant.—I am inclined to think the potassio-mercuric iodide is the most suitable for this quantitative method. It has besides the advantage over the ferrocyanide and tungstate of providing without calculation the amount of albumen per cent. in decimal points: for instance, if it be necessary to increase by dilution the volume of a urine five times, the amount of albumen will be ·5 per cent.

The Mode of Testing.—The exact dimensions of the test-tube are of as much importance in accurately applying this quantitative method, as is the limitation of the opacity provided by the devices already referred to. I have found a flattened tube preferable to a round one, though the latter is available.[1] Twenty minims of the urine are poured into it; then the test-paper is dropped in, and the contents of the tube are shaken, or are made to oscillate up and down the tube while the thumb is held over the mouth for about a minute, when all the albumen will be precipitated. If the opacity completely obscures the printed lines, dilution may proceed pretty freely, until it is seen that the limit is being approached: then the paper may be extracted, and the water is added with some care—not more than ten minims at a time. After each addition the printed lines are placed close behind the tube, and when the fine lines can be detected (as when viewed against a bright light such as that of the sun or a lamp, or by good reflected light), though still obscured (as indicated by the degree of blurring provided by the alumina standard or the opaque glass[2]) the proceeding is at an end.

I have frequently observed that the last step can be reached

[1] The flattened test-tube—provided with twenty graduations of ten minims each—nipple pipette, and the permanent standards, are supplied by Messrs. Wilson, Harrogate, and other vendors of the test-papers.

[2] These are useful guides for training the eye to this mode of observation; but, after a little practice, the observer will learn to use the printed lines correctly without them.

by the further dilution of merely ten minims, which represents only ·05 per cent. of albumen; and in case of doubt as to whether the limit has been reached, the addition of this small quantity of water will, as a rule, resolve it. It is a good plan to equalise the blurring of the lines with that of one of the permanent standards, and then to slightly overstep it: in this way the observer becomes well assured of the fact. It is an important precaution to see that the opacity is as uniform as possible just as each observation is being made: with this object in view the thumb should be placed over the mouth of the tube, and the contents should be shaken or mixed up without frothing them, and the observer should decide before flocculi begin to form.

If the urine is known to be pretty strongly albuminous, it is a good plan to dilute the measured portion of it to twice or three times its bulk, before adding the test-papers, and to adopt the scale (·2) provided by the thick lines.

If on diluting to 200 minims (the limit of the graduations on the test-tube) the opacity still overblurs the printed lines, 100 minims should be removed, and dilution should proceed either as before (*i.e.* by adding twenty minims at a time) or by steps of ten minims. Of course now the latter—not twenty minims, as at first—represent the standard value.

If the observer prefer to commence with a larger quantity of urine than twenty minims (*e.g.* forty), the dilutions which are to represent the percentage value of the standard should be, of course, similar multiples of the same volume (forty minims).

When the limitation provided by the printed lines has been reached, the calculation of the albumen becomes an easy matter, for the number of times the volume of the urine has been increased by dilution represents so many standard units per cent. of albumen; *e.g.* on using the mercuric test-paper, if it is found necessary to dilute the twenty minims of urine to 180, the quantity of albumen is ·9 per cent.; twenty minims of urine with the ferrocyanide test, requiring dilution to 180 minims, contains $1\frac{1}{8}$ per cent.

On using the mercuric paper each dilution (*e.g.* twenty minims) equal in volume to that of the urine represents ·1 per cent.; and half such dilution (*e.g.* ten minims) is equivalent to ·05 per

cent. When the urine is albuminous to about or under ·5 per cent., or when it is strongly charged with albumen, but before the testing is definitely diluted to a lower percentage, it is an easy matter with this quantitative method to calculate the percentage of albumen into the second row of decimals. Such minuteness, however, can rarely be required in clinical work: I merely point out its feasibility by this mode of observation. Most observers will doubtless be satisfied if they can definitely record the percentage of albumen by figures as low as the first series of decimals: the method I am proposing will enable them to do this in two or three minutes.

The printed lines with one of the permanent standards are very useful when only small quantities of albumen are met with: for with their aid the amount can be at once readily and definitely decided; when, for example, they are too clearly discernible through the opacity, the mercuric test-paper having been used, the proportion of albumen is below $\frac{1}{10}$ per cent; or when the estimation merely requires the urine under examination to be diluted to twice or three times its bulk, it is $\frac{1}{5}$ or $\frac{3}{10}$ per cent.

The Quantitative Value of each Test-paper.—On submitting twenty minims of urine to examination, the quantitative range of a ferrocyanide or tungstate paper is at least 4 per cent., and that of a potassio-mercuric iodide, now to be supplied, 3 per cent. Inasmuch as these large proportions of albumen are only quite exceptionally met with, one test-paper will therefore cover all the ordinary amounts, and the observer will only rarely require to use a second.

The Quantity of Albumen met with in Urines.—The general results of my own observations may be thus expressed: as a rule albuminous urines contain less than 1 per cent.; only now and then the amount rises to 2 per cent.; and it is but a rare observation to find more than from $2\frac{1}{2}$ or 3 to 4 per cent. There is, I think, a general impression that much larger quantities of albumen than these appear in the urine: but I am persuaded that further observation will disprove it, and show that it is groundless. It is not probable that the urine will ever contain more albumen than exists in the blood-serum from which it is derived. Now Hammarsten[1]

[1] "Ueber das Paraglobulin," *Pflüger's Archiv*, 1878.

showed that the total proteids of the serum of man did not exceed 7·619 per cent., of which the proportion of serum-albumen was only 4·516 per cent.—the remainder being paraglobulin. Until trustworthy evidence is adduced to the contrary, I must regard the proteid charge of the serum as indicating the possible maximum amount of the albuminoids which may appear in the urine.

The Daily Amount of Albumen discharged.—As with other quantitative estimations of urinary constituents, so with this, it is the determination of the percentage in a portion of the urine of the whole day, and the total amount thrown out during the twenty-four hours, that is clinically of most importance. When the urine examined is part of the daily yield, and the latter has been measured, it is not difficult to arrive at the total daily loss of albumen in intelligible figures; for it is only necessary to multiply the percentage by four and a half[1] to arrive roughly at the number of grains to the fluid ounce: *e.g.* albumen decimal-six per cent., the twenty-four hours' urine, forty ounces, $(\cdot 6 \times 4\frac{1}{2} \times 40) = 108$ grains daily discharge of albumen.

The clinical value of albuminometric estimations can of course only be determined by extended and properly directed observation: but whether considerable or insignificant, it can only proceed from the use of some ready and yet sufficiently exact method which all practitioners may use.

[1] The correct multiplier for converting the per cents. into grains to the fluid ounce is 4, 36.

THE MEDULLA OBLONGATA IN ITS RELATIONS WITH SEXUAL DISORDER, AND ON LOCAL BLOOD-LETTING AS A MEANS OF TREATMENT.

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THE medulla oblongata, which forms the bond of union between the brain and spinal marrow, has been called by Flourens and his school the nodus vitæ, the middle point, or the centre of the nervous system,[1] the "central nervous system" described by Michael Foster "as that as yet almost unknown territory."[2] Treating of its general anatomy, Erb asserts that "many points, and these perhaps the most important, are still unsettled; of its internal structure very little is known with certainty and accepted by all, and the few facts of this nature may be well described as landmarks in an unknown region."[3]

The physiology of the medulla oblongata is just as imperfect and obscure as its anatomy, so that we have not become possessed of any undisputed information on the most elementary and important facts; we know nothing, for instance, of the conduction of sensory impressions, or of the exact position of the chief centres.[4]

At birth, the medulla oblongata is in a much more advanced state of development than the brain; according to Virchow, quoted by Charcot,[5] "the life of the nervous system in the

[1] Van der Kolk, *On the Medulla Oblongata*, p. 87.

[2] Michael Foster, "Address on Physiology," *British Medical Journal*, vol. ii. 1880, p. 285.

[3] Erb, "On Medulla Oblongata," *Ziemssen*, vol. xiii. pp. 825-832.

[4] *Op. cit.* p. 852.

Charcot, "Localisation of Cerebral and Spinal Diseases," p. 160.

newly-born child is almost exclusively centred in the medulla oblongata and spinal cord, and the child is only capable of instinctive acts of reflex character; suction, for example, is totally independent of the will, the volitional centres being then undeveloped. Further, in a lecture delivered before the New York Medical Society, Hammond insists that the seat of instinct is exclusively in the medulla oblongata, its influence being best evidenced in the functions of nutrition and reproduction, the preservation and continuation of the species. In support of his thesis Hammond quotes the case reported by St Hilaire, of an acephalous monster that sucked, cried, and opened and shut its eyes."[1]

A similar case of arrested development occurred within my own experience in 1875. This child survived for seventeen hours, and, in the absence of the cerebral hemispheres, cried, and swallowed with ease, but, for obvious reasons, was not applied to the mother's breast; both feet were clubbed, toes of right foot absent, toes of left foot distorted, fingers of left hand webbed, fingers of right hand almost deligated. We know that frogs whose cerebral hemispheres have been removed will execute swimming motions when placed in water or in the prone position, and will croak when stroked on the flank; but if the medulla be removed, leaving only the cord, they execute none of these movements, showing that the sense of instinct so strong in the frog lies in the medulla oblongata. The sexual function in the infant is only in the nascent state, and, according to Foster, whatever the nascent period, each centre requires external stimuli to develop its structural potentialities.[2] In the words of Dr. Parsons, in the discussion on Hammond's paper, "The sexual instinct does not exist in the fœtus or in the earlier years of infancy, but, as soon as the ovaries or testes begin to develop reproductive functions, the higher centres, which had only hitherto possessed the sexual instinct in potentiality, begin to exercise the functions or to develop the force in reality; but as soon as the reproductive or co-ordinating instinct was developed in the higher centres, these higher centres also became the originators of the force. The sexual instinct has its origin,

[1] *Journal of Nervous and Mental Disease*, New York, January, 1883, p. 67.
[2] Foster's *Text-Book of Physiology*.

not alone in the nerve centres or in the reproductive organs, but in both of them." [1]

While the existence of centres in the medulla oblongata for reflex functions, for cardio-inhibitory, for respiratory, for convulsive and other centres, is universally recognised, their relative positions are but matters of conjecture. They have no lines of demarcation ; on the contrary, they often meet at many points, and, so to speak, overlap one another. It is thus that the normal expiratory division of the respiratory centre is connected by the closest ties with the convulsive centre. Although its existence has not so far been demonstrated, I am satisfied that a centre for the genital or reproductive functions may logically be inferred to exist in the medulla oblongata. On this point Van der Kolk writes : "The close relation between the medulla oblongata and the action of the genital organs is generally received by physiologists. Let it suffice to call to mind the occurrence of erection and emission in persons hanged, how the sexual action is exalted in idiopathic mania with irritation of the brain and medulla oblongata, how frequently after injuries of this part erection and emission, or perhaps impotence, is observed." Killian succeeded in exciting movements in the uterus or tubes of pregnant guinea-pigs by irritating the medulla oblongata; and Eckard has shown that galvanic stimulation of the crura and medulla oblongata in the dog will produce erection, although a similar stimulation of the cerebellum produced no such effect; in rabbits [2] also like effects were produced by electrical stimulation of the pons. The pathology of the medulla oblongata, according to Erb, is still in an undeveloped state [3] and of very varied character; thus it is subject to the hyperæmias and capillary dilatations of the encephalon, and to the degenerations, primary and secondary, which prevail in the cord. Besides diseases due to organic lesions, many symptomatic forms of disease owe their origin to a morbidly elevated sensibility and irritability of this portion of the neuro-axis, although the primary irritation may often be remote, and have its starting-point in the digestive or generative organs. It is thus that convulsive dis-

[1] *Op. cit.* p. 69.

[2] Van der Kolk, *On Medulla Oblongata*, p. 268.

[3] Erb, "Diseases of the Medulla Oblongata," *Ziemssen*, vol. xiii. p. 863.

orders such as epilepsy arise, requiring only increased excitability or congestion of the medulla and the peripheral stimulus transmitted from a spinal nerve, from the vagus, or the sympathetic, to initiate a fit. That the proximate cause of epileptic convulsions lies in the pons and medulla oblongata has been abundantly established by "Van der Kolk, Kussmaul and Tenner, Brown-Séquard and Schiff, Reynolds and Eccheveria." [1]

In the etiology of epilepsy and a large class of allied neuroses and neuropathic disorders, sexual excesses hold a prominent place, and that they stand in causal relation to many spinal diseases is attested by Romberg, Nasse, Hammond, Salmon, Rosenthal, and Erb.[2] Thus hystero-epilepsy, hysteria, chorea, tabes, neuralgia, chlorosis, leucorrhœa and dysmenorrhœa, spinal irritation, neurasthenia spinalis, abnormal seminal losses with their attendants, onanism and masturbation, may be classified as belonging to the neuropathic constitution; and of this condition Erb thus expresses himself: [3]—"The profound influences exerted upon the nervous system by the genital organs before and after puberty, the great revolution that is effected in the entire organism owing to the awakening of the sexual activity, the extreme irritation of the nervous system from overpowering desire, and the exhaustion from over-frequent or unnatural gratification, are only too fruitful causes of those changes in the nutrition of the nervous system which occasion the neuropathic constitution."

The saying of the older observers that "coitum parvam esse epilepsiam" contains a certain amount of truth; almost every fit of epilepsy terminates with seminal emission, and Nothnagel asserts that it is known that in some individuals the first coitus provokes a seizure, which is subsequently repeated every time; the attacks are not unfrequently excited from the direction of the genitals; some women are subject to them quite regularly at the period of menstruation; and I have observed them especially in young girls when the disease declared itself at the same time with the development of puberty." [4]

[1] Nothnagel, "Epilepsy," *Ziemssen's Cyclopædia*, vol. xiv. p. 262.
[2] Erb, "Diseases of the Spinal Cord," *Ziemssen*, vol. xiii. p. 148.
[3] Erb, "Neuralgia in General," *Ziemssen*, vol. xi. p. 25.
[4] Nothnagel, "Epilepsy," *Ziemssen*, vol. xiv. p. 212.

I have at present under my care two female epileptics who attribute the cause of the attack to the early and continued practice of onanism; and the case of a former epileptic patient now in the Belfast District Lunatic Asylum is remarkable in this, that his wife informed me lately that he had not approached her for many years except immediately after the cessation of a convulsive fit.

Closely allied to epilepsy, which they very much resemble in their pathological and etiological relations, stand hystero-epilepsy, and hysteria; the epileptic fit and hysterical seizure have much in common, and frequently cannot be satisfactorily differentiated; the same exciting condition in the brain, according to Jolly, evidently constituting the basis of severe hysterical as of epileptic fits.[1] And although few will accept in its entirety the axiom of Romberg, that "hysteria is a reflex neurosis caused by genital excitement," yet writers such as Jolly include that item in the list of its ordinary causal factors, and refer many attacks besides to uterine displacement and to ovarian troubles; the liability to hysterical seizure at the catamenial period; the bilateral nature of the spasms, so like the crossed or bilateral convulsions of epilepsy; the globus hystericus, which proceeds from the accessory or vagus, imply an irritated condition of the medulla oblongata. Even in the ordinary remedies for both disorders a perfect analogy subsists; the controlling power of cold affusion on the face, shortening the fits by its action on the second and third branches of the trigeminus, through its reflex action on the medulla oblongata, and that remedy so salutary in the case of epilepsy, viz. bromide of potassium, possessing a quieting effect also in hysterical manifestations, through its therapeutic action on the medulla and other nerve centres, as it contracts, according to Brown-Séquard, the blood-vessels of the neuro-axis through the vaso-motor nerves, and thus diminishes reflex excitability.

Passing over for the present the other items in the neuropathic group, I think it will not be difficult to demonstrate the existence of a mutual causal relation between a congested condition of the medulla oblongata and that disease denominated "neurasthenia spinalis," and also that of "abnormal seminal losses." To demonstrate on the cadaver the correctness of this statement would be

[1] Jolly, "Hysteria," *Ziemssen*, vol. xiv. p. 532.

rather difficult, if not impossible, as no one dies directly from the effects of either, and the hyperæmias and congestions of the bulb are often of a transitory nature, and do not always present a perfectly satisfactory autopsy; but reasoning from analogy, and taking into account the nature of the macroscopic appearances frequently presented in a disease in the same category, viz. epilepsy, which almost always is allied with, and frequently caused by sexual excesses, we may fairly assume, along with congestion of the medulla common to both during life, the co-existence in its structure of the histological changes found in fatal cases of epilepsy. For example, in a post-mortem on a case of epilepsy recently reported, Dr. Kingsbury found an increase in the cells of the neuroglia of the medulla oblongata through its entire substance, blood-vessels dilated, and the outer walls infiltrated with cellular elements; the ganglion cells swollen and granular, filling up the periganglionic space in the ganglionic tracts, and posterior region of the pons and medulla. This patient died in the Philadelphia Hospital.[1]

But although failing of necessity in cadaveric demonstration we may still appeal to the results of clinical observation to a pathology founded on the patent phenomena of the disease, and to a plan of treatment in accordance with the pathological view, and withal eminently successful. That this mutual causal relation is in operation we may satisfy ourselves by reviewing the order observed in the development of the phenomena under consideration: how at one time the lower sexual centre situated in the lumbar plexus, stimulated by peripheral irritation of the organs, reacts upon the higher centre in the medulla oblongata; at another the higher centre originates the force and evokes the functions of the lower centre, which in their turn, often independently of the will and while the patient sleeps, (or in those passive diurnal involuntary emissions beyond the control of the sufferer,) are in over frequent activity, in the neuropathic constitution. There is thus established a vicious circle of cause and effect, the repeated excitement of the medulla through too frequent irritation of the peripheral ends of the sensory spinal nerves, or by excessive sexual gratification, induces a state of chronic congestion in the organ whose function is to receive these impressions,—the medulla

[1] See *Journal of Nervous and Mental Disease*, New York, January, 1883.

itself; and the overcharged organ, yielding to abnormally slight impulses, mental or otherwise, so to speak, explodes and causes in the genital organs the evolution of the ordinary phase of the sexual orgasm. It is thus, too, that nocturnal emissions are so readily induced by lying on the back; the already hyperæmic condition of the bulb is increased by an additional afflux of blood due to gravitation in the supine position; the ganglia, so numerous in the medulla, thus excited to action, discharge themselves upon the lower centres, which react on the generative organs, and thus these involuntary discharges take place.

To the scientific student the recognition of pathological truths is in itself sufficiently attractive, but to the practical physician their interest lies not in their abstract nature alone, but principally in their successful application to the cure of disease. As my note-book is replete with examples of neuropathic ailments successfully treated on the lines developed in the foregoing part of the paper, I shall select a few typical cases in illustration.

"Neurasthenia Spinalis."

Case I.—Early in the present year I was consulted by a gentleman from a distant university city, who had been suffering for the two previous years, and had been ineffectually treated by men of eminence. He was in a most abject condition, physically and mentally; he suffered from great despondency and timidity, from vertigo, loss of memory and defective vision, affection of speech, shortness of breath, palpitation of the heart, coldness of hands and feet, great weakness in arms and legs, and unsteady gait. He slept badly, had to abandon reading (as it pained him to fix his attention on any given subject), as well as all his professional duties; he complained of severe pain at the poll shooting down the neck; while attempting to describe his symptoms profuse perspiration in large drops broke out over his face and forehead, he startled at the smallest noise, became nervous at the presence of a female, and this or any ordinary excitement made his heart palpitate and an emissio seminis to take place independent of his will; he admitted that his ailments commenced by the practice of masturbation some years previously,

which were kept up by excessive study; besides the diurnal he suffered from very frequent nocturnal emissions, and these were always succeeded on the next day by racking pains in the head and increased debility. The treatment was simple; at his next visit I applied cupping glasses, wet, to the nape of the neck close to the occiput, abstracting about two ounces of blood. The effect was marvellous; while the blood was flowing he exclaimed that he was wonderfully relieved, that his sight had improved, that his brain depression had nearly departed, that he felt his spirits and mental powers return, and a complete change in his nervous system. He slept well the following night, and had no return of the emissions, his appetite was restored, and a natural feeling of vigour began to appear in his limbs; I now advised the application, three times daily, of a cold douche to the nape of the neck, and permitted him to read for ten minutes at a time. A week later on I found him walking about, his cheerfulness had returned, and he expressed himself most grateful for the improvement. Suffice it to say that, at the end of the fourth week, all his distressing symptoms had departed, and he left town to resume his ordinary duties in the class-room, restored in mind and body. As a matter of prudence, I advised moderation in study, the continuance of the cold douche, and the use of bromide of potassium and belladonna in regulated doses.

Case II.—Some twelve months since a very pale and attenuated gentleman consulted me for a complication of evils; his manner was highly excited and hysterical, his avocations required great mental application and strain, and the effect of these upon his nervous system, with the commission of the practice of masturbation for a number of years previously, had reduced him to a state of despondency which was maintained by daily and nightly erections and emissions which made his life miserable. The irritability had extended to the bladder, so much so that he could not be absent from home for more than half an hour at a time—the calls were so frequent. His nights were most painful, as he had occasion to rise every hour or so to urinate, and each occasion was accompanied or followed by a semi-erection and an emission; his disgust was such that he remained awake the greater part of the night, if possible to

prevent the attacks, and only got a few hours of broken sleep towards morning, when he awoke unrefreshed. He had tried many physicians without effect. I advised the application of the wet pack over the pubic region for the irritable bladder, and, anæmic as he was, I cupped him over the nape, being only able to obtain a small quantity of blood, yet the effect was instantaneous; he was most eloquent in expressing his feeling of relief. His general health speedily improved, he increased many pounds in weight, and for three months had not a single return of the enemy. He then returned to severe study and irregular meals, and had a slight recurrence of the attack; but a second cupping quite restored his equanimity. He wrote to me from England lately, rejoicing in the complete restoration of mental and bodily health.

CASE III. *Abnormal Seminal Losses.*—A writing clerk had been under my care at intervals for about two years for dyspepsia and delicate lungs, with hæmoptysis, night sweats, wasting of the body, restless nights, and nervous debility of hands and feet. On June 23rd, 1868, he informed me that he had up till then concealed from me the fact that he had formerly been addicted to masturbation, and that for the previous three years be was afflicted with nocturnal emissions, occurring generally every alternate night, with an occasional interval of a week, only to recur again, and that the attack was generally ushered in by a feeling of fulness and severe pain at the occiput. The feeling of distress at night was so great that he often feared to lie down, and frequently spent the time walking up and down his chamber till morning. He was induced to unburden his mind by the occurrence of a sudden and severe pain, which began at the nape of the neck, shot down the spine and through both legs, leaving him almost paralysed: he at present suffers much pain and nervous excitement at the lower end of the sacrum and loins. June 24th, I cupped him to-day in the nape of the neck, taking away about two ounces of blood: during the operation he informed me that already he had experienced great relief from the confusion and headache, and that he felt confident of complete cure. June 29th, he stated that he had slept well every night since the cupping was applied, headache much relieved, starting and uneasiness of hands and feet much

diminished: prescribed a mixture of belladonna and bromide of potassium. July 4th, fancied on awaking that he had during the night a slight emission. July 7th, the uneasiness in hands and feet quite gone, spirits much improved, regaining flesh rapidly, chest much better; no return of hæmoptysis. His cure was now complete, and there afterwards appeared in his case what I have often since observed under similar circumstances—a growth of strong hair, commencing at the poll and proceeding down the neck. The progress of the case was so satisfactory that, after the lapse of a couple of years, acting on my advice, he married: and, in the ordinary course, his wife bore him several fine children.

It is needless to multiply examples; my case-book contains many as striking as those adduced, differing from one another in some minor circumstances, but all agreeing in the fact of immediate relief by the same simple agency, in the failure of other remedies. In milder cases I rely very much on the effects of bromide of potassium and the extract of belladonna, with cold douches to the nape; before proceeding to wet cupping, which in every case is not convenient to adopt, I try the effects of dry cupping, frequently repeated, or of a blister "nuchæ collis."

The salutary influence of this topical remedy was also evidenced in a striking manner, in the restoration of the power of the will in several cases where the victim of spermatorrhœa was also a masturbator; it was one of the results for which the patient was most grateful, being thus enabled successfully to resist the odious temptation. This controlling power was established, too, from an unexpected quarter, for, in several cases of epileptic convulsion in females due to onanism practised for many years, the effect of the cupping, while acting as a curative on the principal malady, had simultaneously imparted the long lost power of self-restraint to the poor invalid. The natural inference from the success of this plan of treatment, is that masturbation or onanism is not in itself merely a symptom but a distinct form of disease and amenable to treatment on proper principles. On this subject we may quote the testimony of Van der Kolk: "Onanism is commonly considered, and often correctly, to be a cause of epilepsy, but onanism and excitement of the sexual organs are, to a greater degree than is usually supposed, the

result of irritation and congestion of the medulla oblongata."[1] And further on, "although we have seen that onanism is often the result of congestion and irritation of the medulla oblongata, this does not prevent its reacting most unfavourably on epilepsy, and, so long as it continues, rendering the disease wholly incurable; what I have stated holds good with respect to both sexes, for even among females this vice is not so rare as is supposed."[1]

The ordinary treatment of this neurosis is governed by two main ideas, the first aims at ease by invoking the aid of the moral sentiments and the centres of volition in the cerebrum, the other relies on remedies mechanical or otherwise in the direction of the peripheral nerves and the secretory and excretory organs of generation themselves.

The advocates of the first plan advise the sufferer to give up the habit of masturbation, to be cheerful, take plenty of exercise, lie on a hard bed, to apply cold water to the genitals, and other hygienic plans; in the first place, the local application of cold acts not as a sedative, but as an excitant, but how is the influence of the will to be invoked in sleep, when consciousness is in abeyance and sexual instinct in the ascendant; or what controlling power is centred in the will, sufficient to prevent those diurnal pollutions perfectly automatic in their nature for the most part and in direct opposition to the enfeebled will of the sufferer, who so much in this respect resembles the insane, and however anxious to give up the loathsome habit, yet is dominated by a morbid impulse whose nature he fully recognises, and deplores his inability to resist.

The followers of Lallemand, the votaries of local and mechanical surgical treatment, equally misled by a false pathology, have committed most egregious errors in the name of science; that otherwise able man was too much influenced by local considerations, causing him often to ignore general conditions of great importance, and to rely solely on local and mechanical treatment; for, having in one instance discovered by post-mortem examination the existence of a chronic inflammatory state of the neck of the bladder and mucous membrane adjoining the orifices of the ejaculatory ducts he imagined that he

[1] Van der Kolk, *On Medulla Oblongata*, pp. 268 and 276.

recognised this pathological condition in every case, and therefore usually employed the one-sided treatment, viz., cauterisation of the caput gallinaginis:[1] this plan of treatment, however suitable for the cure of prostatic discharge or that from Cowper's glands was quite useless in the treatment of seminal emissions. Lallemand blundered in mistaking an outpost for the citadel, and in expending all the resources of his art upon the periphery rather than the higher centres, the head-quarters of the sexual system. Equally objectionable, or even more so, are those later expedients, the constant use of the urethral bougie, the ligature of the spermatic arteries, and the indefensible operation of castration as performed in America. This heroic procedure has had its counterpart in the abominable mutilation, the actual cautery, and the clitoridectomy of poor women afflicted with aggravated attacks of hysteria; these import into civilised life the barbarities of Abyssinian savages, in the vain hope, by destroying the passive exponent of excitement in the higher centres, to stifle the sexual instinct at its source.

[1] Curshman, *Ziemssen*, vol. viii. p. 843.

NOTES ON DIPHTHERIA.

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During the last twelve months I have attended a large number of cases of diphtheria, the majority of which occurred in the latter part of 1882 and the beginning of 1883. I have chosen these for remark because they all present some interesting feature. The first case is fairly typical of many others that followed. All the cases were treated like this one, with additions suitable to the various complications that arose.

Case I.—On September 8th, 1882, a girl, aged twelve, consulted me for sore throat, general malaise, and headache. She looked dull and heavy and quite out of her usual lively spirits. The tonsils were slightly swollen and the mucous membrane of the pharynx was of a dull red colour. Next day I found her in bed with both tonsils bearing a few yellow spots or patches. On the 10th there was no material change. On the 11th, I found the left tonsil enlarged and covered with a large yellowish-white membranous exudation. The temperature was over 103° and the prostration was slight. The other tonsil became affected in the same way, and both were cleared of deposit by the 21st. She took food well all through the illness, and did not exhibit much weakness when she got about. The tonsils remained large for some time afterwards. The treatment, after the membrane had formed, consisted of gargling with a weak solution of permanganate of potash, and the administration of a small portion of strong beef-tea, and small doses of quinine, chlorate of potassium and nitro-hydrochloric acid every hour. A sister of this girl died about three or four years before of diphtheria at Southport.

Case II.—Another girl, about twelve, residing a mile away from the last case, had an illness exactly resembling this. Some time after I had ceased attending she came to see me, complaining of thickness in her speech and inability to pronounce her words properly. Her voice sounded muffled and as if she had mucus in her mouth. This defect she dated from her illness. On examination the soft palate was found to hang down motionless, and not to respond to irritation. This girl is one of many children, and the only other case of sore throat in this house occurred some weeks afterwards in an elder brother who had had one of his tonsils removed. His throat was affected only with small spots or patches like what is seen in ordinary ulcerated sore throat, with the addition of considerable disturbance of the surrounding mucous membrane and some debility.

Case III.—A girl, aged six, had an illness resembling Case I. The false membrane reappeared in a slight degree on one tonsil. This child was in the habit of sleeping with her mother, who was in an advanced stage of phthisis. She tended the child and did not take the disease.

Case IV.—A girl, aged eleven, commenced to be ill with general malaise, and in two days her breathing became difficult and noisy, voice whispering, and she had hard brassy cough, pain in the larynx, anorexia, and considerable prostration. Was thought by the friends to be suffering from croup. In two days the laryngeal symptoms improved. Then the left tonsil became affected with yellowish-white patches, which united and formed a thick membrane. There was fever; and the pain which she had in swallowing became very severe after the membrane cleared away; it appeared to be in her ears, as whenever she took food the nurse had to press as hard as possible a finger into each auditory meatus. Just before this symptom showed itself she had brought up some blood and mucus. A carbolic acid spray was used to the fauces, and she gradually improved. She then had pneumonia of the base of one of her lungs and expectorated rusty adhesive sputa. She became very anæmic, and convalescence was prolonged. Her voice continued to be of whispering character for three or four weeks after all throat symptoms had disappeared. A month after the onset of the disease the patient complained of an indistinctness in vision;

that is to say, when occupied in reading, a word would disappear as if a cloud had intervened, in a few seconds the cloud would vanish and then in a short time return. Two months from the commencement of her illness she was again affected with sore throat. Both tonsils and uvula were of a dusky-red hue and not enlarged, and the right tonsil had in the centre a yellow ill-defined patch. She soon recovered, though with much debility.

Case V.—A girl, aged seventeen, was laid up in bed on October 4th with rheumatic pains in both ankles and knees and all along both legs. There was swelling of these joints, fever, and much prostration. She was pallid, but I did not attach much importance to this as she is always more or less anæmic. There was ulceration of the labia minora and of the vaginal wall. The left labium was swollen, inflamed, and very tender, so that examination was very difficult. There was great pain on micturition. October 9th, all the symptoms much better. Was quite well on October 31st.

Case VI.—A girl aged five, had this sore throat in a mild form, one tonsil only being affected; there were no constitutional symptoms. She played about all the time she was ill, and she was not confined to her bedroom. After the membrane was shed the other children were allowed her company. She was nursed by her mother, who attended to her duties as usual. Three weeks after this child was discharged, a sister, aged six, commenced in the same way on November 1st. She was naturally delicate and of very fair complexion. Both tonsils were covered with a large dirty-yellow membrane. There was high fever and marked prostration, and she took her food badly. By November 5th both membranes had disappeared, leaving the tonsils swollen and much reddened. There was no pain at the angles of the jaw on pressure. The depression increased, and I ordered port, but she took very little as it appeared to cause sickness. She now complained of pain over the epigastrium of spasmodic character, her pallor increased, and she died of asthenia after thirteen days' illness. There was no albumen in the urine. After this death a younger child, a strong boy, was affected with the same complaint; he recovered, but was for a time pallid and weak. An older child, a girl, became affected during the illness of the one who died; she

recovered. After this a servant was taken ill with the same kind of sore throat.

CASE VII.—In another family, a boy, aged five, had enlarged tonsils with so-called ulcers upon them. He was ill from October 23rd to November 2nd, and in December all the children had measles and some of them sore throat. At the same time their mother had sore throat with false membranes covering the tonsils, thicker in some parts than in others. They cleared off in two days.

CASE VIII.—A girl, aged eight, had false membranes and high fever. No other child was attacked. This was in November. In March following she had sore throat again with small yellowish patches on both tonsils resembling aphthæ. The left tonsil had an appearance like follicular tonsillitis. The post-sterno-mastoid glands were enlarged, and there was some stiffness of neck.

CASE IX.—A child had membranous disease of tonsils, which lasted five days, and after her recovery a girl, aged ten, who was in the room with her during her illness, was taken ill with slight sore throat. There was no deposit of any kind. The fever ran high, and there was much depression.

CASE X.—A girl, aged four, had measles, and this was followed by membranous sore throat. No other child was affected. The other children had had measles before.

CASE XI.—A girl was taken ill with pain at the epigastrium, and sickness, and high fever, which continued three days. There were no marked throat symptoms, though there was enlargement of glands about the throat. After her recovery an elder sister, who had nursed her, was affected with a sore throat for a day or two, the tonsils having yellow spots upon them. Then a younger child, a boy, was taken ill with fever and enlarged cervical glands about the angles of the lower jaw. There was nothing to be seen in the throat. His urine was scanty, and of a green colour, and contained albumen.

CASE XII.—I attended some children for measles, and while the rash was still out on them the mother was seized with membranous sore throat and swelling of the tonsils (she had had diphtheria some years ago in New Zealand). She had a strawberry tongue, high fever and great prostration. A red

rash then appeared on the chest and nowhere else, it was attended with itching, there was tingling of fingers and toes. She gradually improved, and the skin desquamated. Her daughter, aged twelve, while the measles rash was still out, was seized a day or two after her mother with sore throat. There was no membrane, but the tonsils were angry-looking, the tongue was strawberry and there was much prostration. While her throat was still very sore the skin of her hands desquamated in large pieces, leaving the new skin very red and tender. The desquamation extended all over the body. She recovered slowly, and then had articular rheumatism. Two boys in the same family had measles the same time as their sister. In one it was followed by conjunctivitis, and in the other by herpes of the lip of an indolent character. It was accompanied with pallor and much prostration.

Case XIII.—A child, aged three, had slight sore throat, attended with patches on the tonsils, and was only slightly ill. There were swollen glands (one of which suppurated), scanty urine, and much albumen.

Case XIV.—Three children whom I attended in separate families had in the fauces a thin, semi-transparent pellucid membrane; in one case it was brownish in colour and affected the tonsils only; in another it lay on the back of the pharynx, and was bluish in colour, and was accompanied by a thick coriaceous deposit on the tonsils; in the other it resembled the first one, and was in the same situation, and was accompanied by yellow spots.

Case XV.—A little girl had enlarged tonsils without any deposit, so far as I could see, but examination was difficult owing to her resistance. There was much salivation.

Case XVI.—A gentleman and his housemaid were taken ill on the same day, February 27th, with so-called ulcerated throat, attended with high fever and general aching. He recovered slowly with a moderate amount of weakness. The girl was in bed with the window open on February 28th. On March 1st, the spots had all cleared off the throat. On March 2nd, she was down stairs cowering over a fire with a pulse of 120. And on March 3rd, she developed signs of pleuro-pneumonia of the left base. The inflammation extended to the whole of this lung,

and to the base of the right. Her condition soon assumed a typhoid state, and she died on March 14th. During this girl's illness the cook became affected with a sore throat, exactly resembling those of her master and fellow servant.

Case XVII.—I attended in July a lady with membranous sore throat, contracted in nursing her children. For several days she fancied she heard a chorus of children's voices singing in the distance. This was not constant—it occurred only at those times when she felt very weak. There were no other disturbances of the nervous system. She, knowing her imagination was playing tricks, did not tell me of this until she was better. Her illness was followed by a large abscess on the left side of, and under the body of the lower jaw, and this was accompanied latterly by a discharge of foul pus from the right antrum, which continues in a minor degree to the present time (December). She tells me that her illness was followed by occasional attacks of faintness—and now they occur only at long intervals, and only on unusual exertion.

Case XVIII.—A lady had swollen tonsils with yellow patches on them. When nearly well, the servant, who had been kept quite apart, was found one morning with tonsils both covered with a thick false membrane. She was sent to Monsall Fever Hospital, and the baby who had been accustomed to sleep with her, and did so until the girl went to the hospital, remained quite well.

Case XIX.—A boy, aged twelve, had headache for forty-eight hours, then enlarged tonsils with small yellow patches on them. A brother slept with him until the patches were seen; and he began to be ill in the same way on the third day after separation. The housemaid began ten days afterwards, and next day her tonsils were found swollen and racemose, and there was much constitutional disturbance. The left tonsil looked peculiar. It had upon it numerous projections having a red base and transparent apices, each containing a yellowish substance. They resembled closed follicles overloaded with pus. The cook returned from a holiday after the housemaid was convalescent, *i.e.*, four days after she had been taken ill, and in four days she became affected with a reddened throat and general malaise, There was no deposit. The mistress who nursed these cases did not take the disease.

Case XX.—A boy, aged twelve, had membranous sore throat and when recovering developed sub-acute rheumatism, in right hip joint and to a slight extent in the wrists and elbows. There was fever, but no swelling of these joints. He recovered in a few days.

These cases of sore throat were generally preceded by twenty-four to forty-eight hours of general malaise, headache, and slight soreness of throat. On examination the fauces were found reddened only. Then tonsils became swollen, and upon one or both was found a deposit. A lymphatic gland at each angle of jaw would be found enlarged and painful.

The deposit consisted first of spots or patches, which in course of a few hours would coalesce and form a membrane completely hiding the face of the tonsil. The exudation then became condensed and formed definite and clearly-marked edges, showing the membrane to be thick and coriaceous. In appearance it resembled a piece of wetted new chamois leather, though a little whiter in colour. It generally disappeared in course of a few days and in one piece. Sometimes it formed again, though not to the same extent. The new deposit was of smaller size and not so thick. The tonsil affected was left swollen and reddened, and sometimes glazed or ragged. And it would assume its normal condition only after the lapse of some time, occasionally requiring special treatment to effect its cure.

The constitutional symptoms were fever, aching of limbs, slight depression, want of appetite, and much pain on deglutition especially of solids.

The cases may be divided into the following classes :—

1. *Mild*, where nothing more than tumefaction and general redness of the fauces were to be seen, the constitutional disorder being slight.

2. *Less mild*, where, in addition to the above, there was exudation in the form of spots or patches, the constitutional disorder being marked.

3. *Severe*, where there was a distinct membrane formed.

Such cases as Class 1 I should not have diagnosed as diphtheria, if they had not occurred contemporaneously with distinct cases of this disease. One case (XIX) occurred in a house where all the inmates had been affected with sore throat. The

patient came home from the country quite well, where she had had no intercourse with any sick person, and yet in four days she was seized with sore throat.

In Class 2 the spots or patches were irregular in shape and granular. There was always enlargement of lymphatic glands. In one case an abscess formed in the neck. The constitutional depression was often as severe as in the next class.

In Class 3 the prostration and glandular enlargement were not so great as the local signs would lead one to expect. The lymphatic swelling was not sufficient to be apparent to the eye unless the patient happened to be thin. One case (XVII) was followed by an indolent swelling opposite the left side of the body of the lower jaw. It suppurated slowly, and discharged a large quantity of offensive pus both externally and into the mouth. It healed slowly and left considerable induration behind. It was followed by a purulent offensive discharge from the right antrum. The tonsillar deposit was not generally followed by loss of tissue. One case of Class 3 looked suspiciously like this, but I believe the appearance of it was caused by elevation of the tissue around the deposit. I can recall one case of Class 2 where the tonsil showed a distinct excavation on the site of one of the larger spots. In some instances the deposit had a branched appearance, in consequence apparently of lying in the spaces between the projecting follicles of the gland.

In only two cases can the prostration be said to have been extreme, viz., the one that died, and a boy who had spots only on the tonsils, and who fainted two or three times. The subject of albumen in the urine was not attended to as it should have been owing to my being very busy. But in some of the cases where it was present it was remarkable how slight the symptoms were.

The nervous phenomena were mild. The most severe was the aphonia which occurred in Case IV. It disappeared very slowly. In another (II), there was paralysis of the soft palate, and in another (XII), tingling of toes and fingers. Though only one case of disordered vision came under my notice I was told of several others after the patients had recovered.

In those cases where the disease spread from one member of a family to another, the symptoms were, as a rule, similar,

though Cases IX and XI were exceptional. These show that a mild case can give rise to a severer one, and *vice versâ.*

I have had a great number of cases in all, and it is a matter of astonishment that more were not followed by nervous phenomena.

When the disease affected the Eustachian tubes it was remarkable that firm pressure in both ears relieved the pain produced by swallowing.

Most of the cases occurred in houses where there were other children, and yet in a large number infection of other persons did not take place.

The connexion of this disease with scarlet fever and measles, is, I believe, only accidental. In Case XII the bad throat in the mother's case preceded the rash, and in the girl the throat deposit was contemporaneous with desquamation.

Some of the cases in Class 2 looked like what is ordinarily called ulcerated sore throat, and at any other time than when diphtheria is rife I should look upon them as such.

Two cases (VIII and XIX) exactly resembled follicular tonsillitis. While I was attending these cases of diphtheria I had five cases of aphthous stomatitis, the whole of the mouth being affected in two of them, and in one of these, an adult girl, the throat as well; here too the prostration was very marked, and the convalescence prolonged. No membrane whatever was formed. In the other three the patients were cousins, and contracted the disease, which was of mild character, one from the other.

One case of diphtheria was followed by a large herpetic vesicle on the soft palate. The girl who had this is delicate, and often has one or more vesicles on the eye. Another girl, after her throat was nearly well, developed herpes on the tongue and inside the lips and cheeks.

Another patient had one or more aphthous spots on the tonsils, at the same time as the diphtheritic patches were upon them. At this time there was a depraved state of the general health due to a vitiated state of the atmosphere. Take for instance the girl reported in Case V. I am not sure that this was diphtheritic, for I have not noted whether there was any false membrane. However, it was an asthenic illness. I attended

a child with pneumonia of mild character, followed by another case of the same disease in another child of the family. I lost a case of chronic catarrhal pneumonia occurring in a young child previously very healthy and robust. Measles, scarlet fever, and whooping cough, were prevalent. That epidemic sore throat was not confined to this district is shown by the facts that one of my cases brought the infection with her from a school in Shropshire, and became ill two days after arrival at home. Another girl came home from a school in Lincolnshire, where she reported sore throat had been prevalent. With reference to Case XVI there is some doubt in my mind whether the girl's case was one of diphtherial pneumonia, or whether it was ordinary pneumonia, the result of a chill occurring in a subject already in a very depressed state from diphtheria. The occurrence of pneumonia in Case IV supports the former theory. In the latter case there would be only three days' incubation. However, the existence of fever on the 2nd March, and the pleurisy not occurring till next day, show, I think, that the pneumonia was a constitutional disease. Case XX is interesting as showing a connexion between diphtheria and rheumatism.

The patient was generally kept apart, but often the nurse had other duties to perform. A special outer garment for the sick-room was recommended to the nurse, and disinfectants were used, but the cases show that these alone are not sufficient to prevent other cases arising. And I believe the mildness of the cases obscured their seriousness in the minds of people. One case I had very well illustrates the value of isolation and disinfectants. There was a house full of children, and the eldest boy, who was ill with patchy tonsils, similar to Case XIX, was kept in a room alone, he being old enough to look after himself. His father, who was away at business all day, sat with him in the evening. His meals were left at the door for him, and sanitas fluid was used freely all over the house. No other case arose. Why the baby escaped in Case XVIII, and why the nurses escaped in Cases I and IV I cannot conceive. No systematic disinfection was used in Case I. I suppose we must conclude that babies and adults do not take the disease very easily.

The treatment described was adopted because of the difficulty of teaching young children to gargle. Where the patient was

old enough he was made to gargle with a weak solution of permanganate of potassium, and then take beef-tea, and then medicine every hour. He was allowed anything else he chose to take in addition, provided that it was nutritious in character.

Where the gargle could not be used I was satisfied with the mixture. I have long been in the habit of using chlorate of potassium in throat affections for its local effect, and I believe the addition of hydrochloric acid sets free a little chlorine which would act as a disinfectant. Whether the quinine has any topical effect I cannot say. If the diseased part were in the larynx or at the posterior nares, *i.e.*, where it could not come into contact with anything swallowed, I do not think the mixture would be so useful, nor the gargle either. In such a case I use a spray of carbolic acid or of some other suitable fluid. This method is far preferable to swabbing, as there is nothing disagreeable about it.

This epidemic of diphtheria was evidently of mild type, and, generally speaking, the cases became milder as time went on. I have no doubt this was one cause of its spread. Many cases were doubtless treated by home remedies, not being considered severe enough to call for a medical man. Such patients would be allowed to play with other children before all infection had disappeared, as occurs in other infectious diseases. And I have reason to believe that infection exists for a variable time after the membrane has disappeared.

As to the causes of the disease, it is to be sought for in a depraved state of the atmosphere. In only three cases did I find likely causes in the dwellings. In one there was a very bad state of the drainage arrangements, together with accumulation of filth; in another there was a strong upward current through a grid in the cellar, and in the other close small rooms, many inmates, and close proximity of privy. Many cases arose in houses where the drainage arrangements were apparently good. These would most likely arise from infection from other cases, in schools for instance. Cases occurred early in the epidemic in houses widely apart, showing that the cause was not confined to one spot, and in children attending different schools.

The milk supply was not at fault so far as I am aware, for the district is supplied by many milk dealers, some of whom reside in this locality, and others in outlying districts.

Reviews.

Lectures on Diseases of the Nervous System, delivered at Guy's Hospital. By Samuel Wilks, M.D., F.R.S. Second edition. 8vo, pp. 602. London: Churchill. 1883.

This second edition of Dr. Wilks's well-known handbook (first published in 1878) is very welcome as affording what is on the whole the best handy summary in English of the more obvious facts of nervous disease. It is not too encyclopædic for the general practitioner; it contains abundant stories illustrative and to the point, and a store of practical hints drawn from wide clinical experience. The main substance of the book was delivered as lectures at Guy's Hospital some years ago, and the rapid growth of the subject is shown by the 130 pages that have been added in the last five years to this second edition, in which Dr. Wilks cordially acknowledges Dr. Horatio Donkin's help. There are a few verbal alterations, as, for example, the judicious omission of a 'not' (p. 53) and the transference of the credit of the early observations of rhythmical spasms from Sir J. Paget to his elder brother Prof. G. E. Paget (p. 586). In the gradual expansion of a book in which the form of lectures is retained throughout there can hardly help being such trifling inconsistencies as in talking of Broca's essay of 1861, and Charcot's experiments of 1882, as about equally recent; in speaking of Todd's article of 1847 on ataxy indefinitely as of "more than twenty years ago;" and of the use of subcutaneous injections as "novel." But the book has not half a dozen references, and makes no pretence to be historical. Its virtue is in its ample practical knowledge and vigorous description in plain terms, which make it easy to realise not only the pathology, but the patient, and in the welcome introduction of stories to clench the memory with an instance. "A patient of mine" (with locomotor ataxy) "assured me," says Dr. Wilks, "that whilst at Margate he walked a long distance along the road, and then, wishing to stop in order to return, was obliged to guide himself up the bank, where he fell down. I know a

case of a gentleman afflicted with this disease who, if he stops to look in at a shop window, is unable to start himself again, and asks some one near him to give him a push." The style is easy, and the manner in parts conversational, suiting an author who does not allow himself to dwell long on the deeper psychological relations of morbid nervous states. He briefly states that "the mental conceptions which we possess are intimately associated with, if not the actual products of, the material impressions which caused them" (p. 7), and goes on first to the clinical description of the cerebral diseases, which is one of the most thoroughly satisfactory parts of the book. The description of aphasia is excellent; the subject is one to which Dr. Wilks has for long paid special attention, as evidenced by a previous essay. Much novelty can hardly be expected in a subject of late so eagerly investigated, but Dr. Wilks adds one remark seldom to be noticed elsewhere: "It is interesting to observe that in the phrenological system of Gall and Spurzheim the organ of speech was placed in the identical region which has now been discovered by actual demonstration to be its true site. Gall says, 'The manifestation of verbal language depends on a cerebral organ, and the cerebral organ lies on the posterior part of the superior orbital plate.' Many cases are given in the *Transactions of the Phrenological Society* in support of this doctrine" (p. 72).

The review of hemiplegia is greatly extended from that of the first edition, and contains an account of the secondary degenerations in the spinal cord drawn mainly from Charcot and Erb, and an interesting and impartial discussion of hemianæsthesia, to which Charcot has drawn so much attention. "For my own part," writes Dr. Wilks, "I have not yet met with a complete case of hemianæsthesia having an organic cause; my cases have always been functional, and in most cases have occurred in hysterical women" (p. 54). That a few organic cases occur as consequences of lesions of the posterior part of the internal capsule is commonly held; and, even when there is no opportunity of pointing to the cause of the hemianæsthesia after death, if there is associated ophthalmoplegia the disease is not generally held to be functional; for that complication is probably one of the few that are exceptions to the general rule which Dr. Wilks is anxious to enforce, that "there is no affection of the nervous symptoms due to an organic cause but what may be simulated by a functional and curable one."

The second division of the book, which deals with diseases of the spinal cord, is that which has undergone the most revision: it is in this department that our knowledge has received most recent extension, or, at any rate, rearrangement. It is here especially that some short guide to diagnosis is wanted, and this

would be a welcome addition to Dr. Wilks's descriptions. It is impossible to compress into a one-volume handbook a thoroughly complete account of such a long and varied disease as locomotor ataxy without squeezing it dry of interest; and we are glad to notice that Dr. Wilks has nearly doubled the description of his earlier edition, and added to it the symptoms of ataxic arthritis, Argyll Robertson pupils, tendon reflexes, and mental states; a few lines more on the *crises gastriques* and some laryngeal symptoms may perhaps be added hereafter. The description of "rhythmical paralysis," as he calls the *sclérose en plaques*, is very short. He remarks on the occurrence of its symptoms in children (as observed by Dickinson, Bristowe, Cheadle, etc.), without any fatal issue to enable any definite opinion to be formed as to their cause. A post-mortem examination, however, comparatively recently performed by H. Schüle (*Deutsches Archiv f. klin. Med.* vol. viii.), shows the same lesions as in adults.

It is plain to any reader that Dr. Wilks has drawn mostly from his wide personal observation, much in Guy's Hospital, much elsewhere, and that this is one of the main factors which make his book so interesting compared with much laborious literature on the same subjects. It must be remembered with all the more regret that no English field of hospital experience is approximately as great as that of *La Salpêtrière*. Dr. Wilks has suffered, he tells us, himself from migraine, most unfortunately for his own comfort, but perhaps he may be partly consoled by noticing how much life it has given to his description of it. Few maladies have been equally fortunate in securing excellent observers as its victims, and historians such as du Bois Reymond, Wollaston, Sir J. Herschel, and Sir G. Airy.

The therapeutics of nervous diseases are unavoidably the most disappointing part of this discussion : for there is not even a hypothetical *bacillus nervosus* who may be combated in future, and on whom at present the blame may be thrown. Dr. Wilks has a few words to say for the usefulness occasionally of electricity in therapeutics as well as diagnosis; of drugs he speaks with a familiarity which has led almost to contempt. "None of these remedies" (belladonna, conium, hyoscyamine, jaborandi,) "are of much value in purely nervous affections. I should say the same of *strychnia*, a medicine whose value is slight considering the extent to which it is administered. . . . I should say the same of *aconite;* it is a drug which, acting powerfully on the nervous system influences nutritive processes in various parts, but its direct operation on the centres so as to alter their morbid states appears to be very slight indeed. . . . *Cannabis indica*, which has so powerful an effect on the nervous centres, is a very poor medicine, although I have spoken of its benefit

in migraine. *Phosphorus* is again coming into use in nervous affections, but is in my opinion all but valueless. *Gelseminum* is our new remedy for neuralgia; and *camphor* is a good thing to play with. *Bromide of potassium* appears to be useful in a few complaints. Like all medicines of universal application it cannot be regarded but as a very poor remedy" (p. 590). To "massage," or shampooing, he just alludes: in the practice of Dr. Weir Mitchell and Dr. Playfair we cannot help thinking its results have been sufficiently striking to call for a larger trial. But the general review of his curative agencies leads him to confess honestly in his concluding sentences that "the doctor soon finds that in treating his patient the practice of medicine is not only one of physic but of psychology, and that the effect of the drugs depends as much upon the constitution of the patient's mind as of his body."

Life History Album. Prepared by direction of the Collective Investigation Committee of the British Medical Association, and Edited by FRANCIS GALTON, F.R.S. Chairman of the Life History Sub-committee. London: Macmillan and Co. 1884.

THE Collective Investigation Committee have taken a new departure. One of the first objects set before them on their appointment was to enquire into the inheritance of disease, and though the difficulty of the subject led them to prefer easier and simpler investigations for their first essay, now that they have found their strength they have taken up in earnest this question of heredity.

The way in which they have approached it will probably be surprising to some; but we think we can trace a deliberate intention in their action. If they had wanted immediate returns on this subject from medical men there is no doubt they could have had them in any number, though not by means of such a publication as this *Life History Album.* By issuing this Album they have made a bolder venture, namely, to infuse or stimulate among the lay public the habit of keeping such records as may give medical men trustworthy data for wide research. "Family histories" are the source of all our conclusions as to heredity; but our patient generally knows about as much of his great grandfather's medical history as he knows of the complexion of his miocene progenitors. The thanks and aid of the profession are therefore due to the Committee for their public-spirited effort to awake the public to the need and the value of the missing facts. It has been said that the Album is a bait for hypochondriacs. It would be equally true to say that it offers a premium to vain-glory. Self-knowledge and self-observation are not hypochondria, and do not lead to it in this

or in any other era. "Know thyself" was not the maxim of a hypochondriac. It seems to us that the Album errs if at all on the side of diffuseness. There is perhaps too much stress laid on the minuter observations of growth and development. To be met every year of one's life up to twenty-five with questions about one's teeth, and one's right and left ears, is a little tedious. But in a completely new line such as this one must not expect the first attempt to be quite perfect. The Committee have taken a praiseworthy step towards a most valuable and important reform, and it will be acknowledged by all who have their eyes open in the direction of progress that they deserve the best support that the profession can give them in their endeavours.

Surgical Applied Anatomy. By FREDERICK TREVES, F.R.C.S. Assistant Surgeon and Senior Demonstrator of Anatomy at the London Hospital. London: Cassell & Co. 1883.

IN this little volume, which is one of the *Manuals for Students of Medicine* published by Cassell and Company, most of the important facts of anatomy and surgery are carefully and judiciously welded together. It is likely to fulfil the intention the author had in view in its production, which was to provide "mainly for the use of students preparing for their final examination in surgery." The descriptions are clear and good; and the author adds to the practical value of his book and raises it above the level of some others of its kind by apt illustrations drawn from his own experience and the writings of others. The illustrations are chiefly from the works of Braune and Rüdinger, which, however, though generally excellent, are not always in every particular to be relied on. Thus in the vertical section of the knee-joint at p. 436, the position of the patella, which is below its proper level, gives rise to the statement easily disproved in the living subject, that "a knife passed horizontally backwards at the apex of the patella would, when the limb is extended, just miss the joint line between the femur and the tibia, and would hit upon the latter bone." Probably the exigencies of examination-preparation may have preponderated against the desire to change certain conventional expressions. Thus the movement of the ankle, in which the raising of the heel is effected by the gastrocnemius, the flexors of the toes, and other muscles on the flexor aspect of the limb, should, out of respect for the homologies of the wrist and other considerations, be described as *flexion* instead of *extension*. Lest, however, it may seem captious to take such exceptions, we hasten to add that they certainly will not prevent the book from

becoming a valuable aid to the student and a useful reminder to the practitioner.

Elements of Surgical Pathology. By AUGUSTUS J. PEPPER, M.A., M.B., London, F.R.C.S., Edinburgh. Surgeon to St. Mary's Hospital, and Teacher of Practical Surgery. London: Cassell & Co. 1883.

THIS manual, of the same series as the above, and like it intended to meet the requirements of students preparing for their final examinations, is well adapted to do so. We do not look in such a manual for novel ideas or any specially attractive garb for the old ones. It is enough that these are well selected, well put, and well marshalled; and this appears to be the case throughout Mr. Pepper's little work.

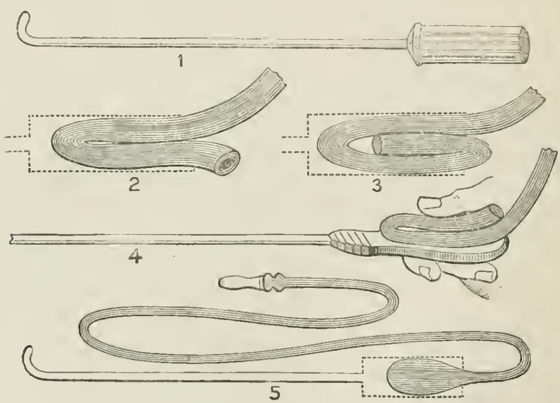
The Relation of the Eye and Spinal Diseases. By A. FRIEDENWALD, M.D. Baltimore: 1883.

IN this pamphlet the author gives the views of most of those who have written on the subject. He considers that, from the general pathology of the disease, we may assume that in multiple cerebro-spinal sclerosis the optic nerve affection does not depend upon any direct influence of the diseased cord, but that from the diffused character of the disease, both the cord and the eye are independently attacked. In those more acute cases, however, when the spinal disease and the eye trouble apparently stand in relation of cause and effect, the simplest explanation that suggests itself is, in his opinion, that an inflammation having reached the spinal meninges has ultimately extended to the meninges at the base of the brain, and finally to the optic nerves. In the chronic forms, this explanation is not feasible, and we must admit that the ocular lesion is the result of a vaso-motor disturbance conveyed in the tract of the sympathetic nerve. It is possible that both conditions may operate simultaneously in some cases.

Clinic of the Month.

The Lithophone.—Dr. McKenzie Davidson, of Aberdeen, writes as follows: In the *Lancet* of July 1st, 1882, I wrote a short article entitled "A New Mode of Detecting Stone in the Bladder—the Auditory Method." It was there stated that vibrations produced in a sound by its contact with a calculus were readily conveyed to the ear by means of an indiarubber tube, one end of which was attached to the handle of the sound, while the other was held to the ear, the ordinary bladder-sound being converted by this means into a kind of stethoscope. Direct experiment on the dead subject proved that the larger the bore of the tubing employed the better were the results. The largest bore of tubing thus used was three-eighths of an inch in diameter, which gave the greatest intensity. But the weight of a tube of that size was an obstacle to the delicacy of touch. This difficulty has been overcome, however, by attaching smaller and lighter tubing in a manner to be described, which gives equal intensity, but without the drawbacks of the larger and heavier tubing. I had always fastened the tubing, slipping it over the handle of the sound if the tubing had a bore large enough, but if the tubing had a small bore it was slipped on to a little projection from the handle made for the purpose. But the method of attachment that carries the greatest intensity of sound is as follows:—A piece of india-rubber tubing about twenty-six to thirty inches long, with a small bore (three-sixteenths to one eighth of an inch in diameter) is employed. About an inch from one of its ends it is folded on itself, and this part is then held tightly against the handle of the sound, as shown in Fig. 4, care being taken that the long part of the tube that goes to the ear lies next the handle. It can be retained in position by a small clamp, instead of being held by the fingers. By this simple means greater intensity of sound is conveyed than by a tube of much larger bore, attached by merely slipping it over the handle. It is probable that the intensity thus attained is due to the part of the tubing pressed against the handle of the sound acting as a

"drum." And by means of it the vibrations get transferred from the sound with little loss to the column of air within the tubing and thence, of course, directly to the membrana tympani. To carry out this plan of fastening the tubing in a convenient manner I constructed a sound with a hollow cylindrical handle, open at the end like the mouth of a gun (see Fig. 1). The stem is of solid steel and nickel-plated, and does not differ from the short-beaked sounds now in use. The handle is two inches and a quarter long, and hollow, with a diameter of half an inch. Externally it has roughened longitudinal ridges, for convenience in manipulation. A smooth band along the anterior part indicates the position of the beak of the sound. This instrument can be used either as an ordinary sound or, when desired, tubing can be readily attached. A piece of small and light india-rubber tubing, about thirty inches long, is bent at one end, as before described, and the loop so formed is thrust into the tubular handle, as shown in Fig. 2. The other end, fitted with an ivory or bone earpiece (such as is used with the otoscope), is put into the ear, where it should remain fixed without requiring to be held. If the tubing be of very small bore, then its end may have to be folded or coiled, as shown in Fig. 3, in order that it may fit tightly into the hollow handle of the sound. It is always necessary that the part of the tubing that leaves the sound to go to the ear should



Reduced one-fourth.

be tightly pressed against the handle of the sound. A binaural arrangement can be easily made by taking a piece of tubing double the length (about four feet and a half or five feet long), folding this in the middle, and thrusting the loop at the bend into the tubular handle of the sound. The two free ends, armed as before with earpieces, are placed one in each ear. The note

is thus intensified greatly, but for all practical purposes the single tube is quite enough. However, with the binaural two persons can listen at the same time, and so verify the diagnosis with greater exactness. A convenient form of lithophone is shown in Fig. 5. The same sound is employed as shown in Fig. 1, but instead of a simple indiarubber tube one with a ball at one end is used. The bulb is egg-shaped, and barely exceeds half an inch in diameter at its widest part. It can be readily squeezed into the tubular handle, by folding the ball longitudinally and so introducing it into the handle, where it becomes tightly fixed by its own expansion. The other end is fitted with an earpiece. This instrument gives good results. The lithophone does not hamper the delicacy of touch in exploring the bladder. The tubing is light, and is attached in a manner which allows great freedom of movement. The exploration of the bladder is carried on by a combination of the senses of touch and hearing. A particle of sand weighing less than 1/500th of a grain lying on cotton-wool was detected by hearing its contact with the lithophone. It could not be detected by touch alone when the tubing was detached. Of course this extreme delicacy is not required in the bladder, but it serves to show the sensitiveness of this auditory method. In ordinary cases a common sound will do quite well, but in difficult and obscure cases there can be no harm in bringing an additional sense to our aid. It remains a fact that calculi are occasionally not detected even by skilled hands. And it is more than likely that the lithophone will prevent the general practitioner sending so many doubtful cases of stone to the specialist. The former, who sees as many cases of stone in a year as the specialist in a day, cannot be expected to possess the *tactus eruditus* to the same degree. But with very little experience he will soon learn to detect the unmistakable sound produced by the contact of the lithophone with a calculus, or with even a small fragment.

In the article before referred to it was an oversight of mine to call this auditory method new, for it appears the idea was first suggested in the *Irish Hospital Gazette*, 1873, a fact entirely unknown to me at the time. (*Lancet*, Nov. 3, 1883.)

Resection of the Stomach and the Gastroscope.—Professor J. Mikulicz, of Krakaw, has written a series of articles in the *Wiener medicinische Wochenschrift*, giving an account of a successful case of stomach resection performed by himself, and of the utility of the gastroscope in connexion with these operations. There had been, up to July, thirty-two cases of stomach resection reported. Among these there were twenty-six deaths and eight recoveries, giving a percentage of recoveries of twenty-five. Three of the cases were operated upon for gastric

ulcer with stenosis, and of the three, two recovered. There were, therefore, twenty-nine cases of cancer of the stomach, with five recoveries, from the operation. Of the twenty-four fatal cases, the cause of death in fifteen was collapse, in one inanition, in five peritonitis. In the opinion of Mikulicz, the death of the last six by inanition and peritonitis was due either to deficient skill in operating, or to conditions which, at present, our better knowledge can prevent. As for the deaths by collapse, there is hardly an operation in surgery which has had relatively so many victims from this cause. The explanation lies not only in the length, character, and severity of the operation, but especially in the fact that the patients are generally already weakened by the disease. There is no operation in surgery which has had its technique and, we might say, indications so well defined in so short a time. It is now generally admitted that the operation is justifiable, but only in the most carefully-selected cases. The diagnosis must be exactly made, the growth must be still small, the disease in a comparatively early stage, and the patient not greatly weakened or marasmic. It is in the hope of its assisting to a more exact diagnosis that Mikulicz recommends the gastroscope [*Practitioner*, xxviii. 140]. He has examined a number of healthy and carcinomatous stomachs with this instrument. In the healthy stomachs the pylorus appears like a longitudinal split, or like a star-shaped, oval, or circular opening, which is surrounded by a thick wall of red mucous membrane. The muscular wall is constantly in motion. In cases of cancer the thick protuberance about the pylorus is either entirely absent, or is thrown up in small folds. The powerful muscular action of the pylorus is absent. The gastroscope is evidently not yet a great help in the matter of diagnosis, but further observation and use may make it more so. (*New York Medical Record*, Oct. 27, 1883.)

Thomsen's Disease.—The following paper, by Dr. Greffier, appeared in *La France Médicale*, April 19, 1883:—"This is an affection quite novel and very curious. Westphal, who has presented two cases of it to the Society of Medicine of Berlin (*Le Concours Médical*, March 31, 1883), proposes to designate it *Thomsen's Disease*, because that physician, who suffered from it with all his family, was the first to give a true account of it.

MM. Ballet and Marie, who published an interesting article, on this subject in the *Archives de Névrologie* (Jan. 7, 1883), gave it the name of "muscular spasm at the commencement of voluntary movements." Other designations have been proposed: we have adopted the first, because of its brevity, and because it expresses no opinion as to the nature of an affection as yet so little understood. Whatever it may be, thanks to the

researches of MM. Thomsen, Leyden, Seeligmüller, Bernhardt, Westphal, Ballet, and Marie, &c., it seems quite possible to trace the history of this malady, which must be considered a special morbid entity.

Etiology.—It is necessary at the outset to emphasise the influence of *heredity.* Dr. Thomsen, a sufferer from it himself, has been able to trace it in three generations of his own family. Heredity is equally noted in the cases of Leyden and Seeligmüller. What should not be surprising to those who are at all well versed in nervous pathology is the fact that, in place of meeting cases of Thomsen's disease in tracing the family history, we not unfrequently find other nervous disorders. Thomsen notes that in his family nervous disturbances are remarkably common; his great-grandmother died of puerperal mania; she had two sisters who presented, at an advanced age, some mental troubles, as did also her son, the grandfather of Thomsen. One of the sisters of the author, not suffering from the affection which is engaging our attention, experienced certain temporary psychical disturbances. So also Bernhardt's case had an epileptic uncle.

Age appears to have great importance, since all the cases date from infancy, and the affection is in the main congenital.

No other circumstance appears constant, and every other condition must, for the present at least, be held as without influence.

Symptomatology.—The essential symptom is the *spasmodic rigidity* of certain muscles occurring *at the moment of executing a movement.* In the case of MM. Ballet and Marie, the patient wishing to go up stairs experienced rigidity when he tried to lift his legs; but after seven or eight steps all rigidity had disappeared. In the same way, when he was made to close his hand, it was a little time before he could open it again. In all these observations the phenomena present themselves in an analogous fashion. Seeligmüller cites the case of a recruit who was the despair of his instructor, because he could not execute the management of his gun with the necessary rapidity and precision. Thomsen's son had a similar experience; being looked upon as a malingerer, he was kept for almost a year under observation in a hospital. In another case of Seeligmüller's, a singer, when she had finished executing a piece, was obliged to rest for some moments before she could commence to walk away; when she played on the piano, her fingers were stiff only at the commencement for a certain time.

Westphal, in the communication which we have cited, expresses himself in these terms:—"In certain circumstances active movements are arrested in consequence of the con-

tracture of the muscles, and these circumstances are as follows:—

(1) After longer or shorter repose of the muscles of the leg, quite suddenly, on attempting to rise, the patient feels rigidity in the articulations of the legs, which have become tetanically immovable. (2) After great muscular fatigue, and even after a single strong effort, as for example in flexing the arm, the rigidity comes on. (3) Also after certain complicated movements, *e.g.*, one of the two cases experienced the phenomenon in throwing off his coat, the other in trying to dance. (4) Contracture comes on after unexpected sensations. The patient, while running, strikes his toes against a small pebble, for example, directly the foot becomes stiff, and he falls, sometimes without having time to protect himself by his arms." This tetanic rigidity of the muscles which are entering on action may, says MM. Ballet and Marie, lead to very odd situations. In the case which they report, when the patient was about to mount his horse, the left leg, just when it was engaged in the stirrup, was all at once seized with rigidity in flexion, while the right, in its turn, was fixed in extension above the crupper of the horse. At last, the rigidity passed off, and he was able to seat himself comfortably in the saddle. It is unnecessary to insist on a fact which comes out sufficiently from the observations we are going to cite—viz., that the *phenomenon comes on only at the beginning of movements.* When these have been repeated a certain number of times, it ceases to be observed.

This spasmodic rigidity affects not only the muscles of the limbs, but equally also those supplied by the cerebral nerves. One of Westphal's cases experienced in speaking a certain stiffness of the tongue, which rendered his speech slow and awkward. It was the same in the cases of Seeligmüller, Leyden, &c. In almost all these cases the facial muscles equally suffered. "During laughing there occurs tension of the muscles of the face; and in mastication, the patient may find himself unable to close his mouth" (Westphal, *loc. cit.*).

The visual apparatus may be affected, so that there is difficulty in opening the eyelids, in turning the eyes in various directions, &c. (Ballet and Marie, Westphal).

The contractures appear to be augmented in frequency and in intensity under the influence of the emotions, of exaggerated attention on the part of the patient, and of chills; according to Thomsen one may, by calling up the phenomenon to one's memory, produce the cramp in reality. On the other hand, by repeating the movements one makes the rigidity disappear. It is noted that the sphincters remain always unaffected.

Almost all the authors indicate that there is *hypertrophy*

of the muscles; it was, however, absent in a certain number of cases (Ballet and Marie, Thomsen, Peter). Muscular force is well preserved, and appears most frequently very considerable. The tendon reflexes are normal. It is the same with electric irritability. In the case of MM. Ballet and Marie, in which the electric examination was made with the greatest care by Dr. Vigouroux, chief of the electro-therapeutic service at the Salpêtrière, there was noted the persistence, after Faradic excitation, either of the contraction itself or of muscular waves, indicating an active state of the muscle during several moments.

Psychical disturbances are but rarely noted. Yet we have indicated the alternation of rigidity of the muscles and mental disorders in the cases of Thomsen and Bernhardt. Sensibility has always been found intact.

Diagnosis.—When so characteristic, Thomsen's disease will not easily be confounded with any other. MM. Ballet and Marie thus establish the diagnosis: *Spasmodic tabes dorsalis* is a disease also congenital, characterised by rigidity of the lower limbs: but this rigidity is persistent, it does not disappear when the movements are continued; it is accompanied by a most exaggerated excitability, as seen in the knee reflex and in the appearance of spinal epilepsy. The upper limbs, the muscles of the tongue and face are unaffected. In *pseudo-hypertrophic paralysis,* there is a true paralysis; muscles of the largest size are extremely weak, and by their side are found others completely atrophied.

Nature of the Disease.—Have we to do with a lesion of the muscular system or of the cord? That is still very difficult to decide. Pathological observations are as yet quite insufficient; Ponfick, having made an examination of the muscles of one of Thomsen's sons, found no lesion. The microscopical examination made by Patrone has given equally negative results. We are thus reduced to hypotheses, which are numerous. Thomsen, having regard to the alternation of spasms and mental diseases in his family, looks on the disease as a psychosis. Westphal views it as congenital anomaly of the muscular tonicity. M. Jaconsiel (Discussion at the Berlin Society of Medicine) proposes to denominate the disease "congenital muscular hypertrophy." The patient whom he saw had the muscles normal, the fibres presenting nothing particular. According to him, the occasion of the contraction is quite capricious and peculiar, and the stimulus increases with resistance, but the patient may nevertheless accomplish what is desired up to a certain point. The muscles, of which the development is extraordinary, are indolent, but not sufficiently inert to atrophy (Fischer, *Le Concours Médical,*

31 *Mars*). MM. Ballet and Marie also blame the muscular system. The extension of the motor troubles to almost all the voluntary muscles, their transitory character, and the phenomena produced by electric excitation, appear to them sufficient proof. Petrone and Seeligmüller attribute the affection to a nervous cause. The first makes it depend on a disorder of conductibility, at some point between the cerebral cortex and the terminal plaque of Rouget. The second calls it "spasmodic hypertrophic spinal paralysis." It is evident that a more complete investigation of this difficult subject is necessary.

Treatment.—On this there is little to be said. Thomsen has used, on himself and his family, the whole therapeutic armament with no effect. (*Glasgow Med. Journal*, Nov. 1883.)

The Initial Lesion of Syphilis.—In a paper recently read before the British Medical Association, Mr. Bernard, Surgeon to the Liverpool Lock Hospital, makes some interesting additions to our knowledge in regard to the situation, period of incubation, and the forms of induration of the primary syphilitic lesion, which should prove to be valuable to those who are especially concerned with these objects of inquiry.

The primary lesion was met with on the inner surface of the prepuce in 118 cases; in the furrow in 71; on the corona in 45; on the skin of the penis in 26; on the outer surface of the prepuce in 23; on the body of the glans in 21; on the frænum, in 11; at the meatus in 10; on the free border of the prepuce in 4; and in the urethra in 1 case. It will thus be seen that the prepuce, including the frænum, was the most usual site of the lesion, the furrow behind the corona coming next in order, and, that the corona was attacked oftener than the body of the glans.

The period of incubation in sixty-nine cases varied from one to fifty-six days, the average being a little under twenty days, which agrees pretty closely with the generally accepted average of the end of the third week. An interesting point in this connexion is the preference given to the multiples of seven as the most usual dates of the outbreak, it having been met with forty-three times out of the sixty-nine. This fact was observed by Fournier in twenty out of forty-five inoculations, and by Lowndes in twenty-five out of forty-seven cases.

Mr. Bernard finds that the induration, in the male, is best marked when the sore is situated on the inner surface of the prepuce and the furrow, where it feels like a piece of cartilage. When the gland is affected, the sensation is rather that of a thickening than of hardness of the part. At the free border

of the prepuce, the induration, although characteristic, is not so elastic as when the lesion is seated on its inner surface. Absence of induration is common when the skin covering the body of the penis is involved, but, when present, it feels like parchment. In the female it is best marked on the nymphæ. When seated on the greater labium the sensation is similar to that when the lesion occupies the glans penis. In the fourchette the induration is not characteristic. (*British Medical Journal,* Sept. 22, 1883.)

Treatment of Granulations of the Conjunctiva.—M. Parisotti approves of the application of a solution of acetate of lead, which is also strongly recommended by Abadie. Care should be taken that there is no lesion of the surface of the cornea, for if such a lesion exists there is risk that some of the lead may be deposited as a white layer on the ulcerated surface, and if this happens to be central, serious impairment of vision may result. If the lead be used at all it should be used frequently and energetically. M. Parisotti obj cts to the employment of caustics, because there is danger that the conjunctiva will be injured, and if so, there is no hope of its recovery. Recently M. Wecker has counselled the use of *jequirity,* an infusion of the seeds of the *Abrus precatorius.* This is made by taking thirty-two seeds, and macerating them for twenty-four hours in 500 grammes of cold water, then adding to them 500 grammes of hot water, and filtering. The fluid is applied to the conjunctival sac with a brush three times daily. The patient is kept in the dark, generally for fifteen days. and severe conjunctivitis follows, the lids become œdematous, and there is copious discharge of pus. M. Parisotti has collated the various statements made by those who have observed the influence of this drug, and believes that it will come into use, inasmuch as success attended its employment in a certain proportion of cases, and no harm resulted in those in which it failed. In particular, the cornea does not become inflamed, nor is any increase observed in such corneal inflammation as may be present. He thinks, however, that a still better plan than this is the excision of the fold of conjunctiva between the tarsus and the globe, and gives the details of several successful cases in support of his view. (*Recueil d'Ophthalmologie,* June 1883.)

The Micro-organisms of Jequirity.—MM. Cornil and Berlioz lately detailed some experiments before the Society of Biology which go to prove that the inflammatory effect produced by jequirity, and made use of by oculists in the treatment of trachoma, pannus, and other similar conditions, is a truly septic process due to the presence of micro-organisms in the solution employed. The latter, during maceration in cold water

of the seed from which it is obtained, becomes the seat of germ-growth. Subcutaneous injection of this material led to the formation of abscesses beneath the skin. Injection within a serous cavity led to inflammation of its lining membrane, and microbes were detected in the neighbouring vessels. If the subject of experiment survived the injection, it was not susceptible to a second series of the septic phenomena, thus showing a certain acquired immunity analogous to that of vaccination. A fourth of a minim of jequirity injected under the skin of a frog gave rise to a general septic inflammation with production of numerous micro-organisms in the tissues. A drop of the blood of this frog after inoculation was similarly infective. The unmacerated seeds of jequirity did not produce these phenomena. The germs injected in the manner described were found to be eliminated by the kidneys, the bowel (causing diarrhœa), and in one case by the skin. In the latter instance, drops of serous fluid formed on the surface, moistening the hairs, which came out, when pulled, with unusual ease. This fluid contained the germs in question. (*Progrès médical*, Nov. 3, 1883.)

Extracts from British and Foreign Journals.

Pepsin.—Dr. Adolphe Tsheppe mentions four methods of preparing pepsin The first method is by scraping the mucous membrane of the stomach, extracting with water, filtering, and evaporating at a moderate temperature, or by digesting the stomach or its mucous membrane, and thus preparing wines or elixirs. The second or French method consists in precipitating the extract from the stomach with acetate of lead, washing the precipitate, removing the lead by sulphuretted hydrogen, evaporating the filtrate to a syrup, and mixing with starch. This method is very imperfect. The third, or Scheffer's method, consists in precipitating an acidulated gastric juice by concentrated solution of common salt, and repeating the process once or twice, when the product gives excellent pepsin. With the addition of sugar of milk it forms the *pepsinum saccharatum* of the U.S. Pharmacopœia. A drawback to this saccharated pepsin is its liability to adulteration by excessive quantities of sugar of milk. The fourth method of preparation is that by which Jensen's so-called crystallised pepsin is prepared. This appears to be one of the most powerful pepsins in the market, and, unlike Scheffer's pepsin, contains the ferment which coagulates milk in addition to the power of dissolving albumen. It is prepared by macerating the stomach in acidulated water at 38°—40°, and drying the product on glass, where it forms transparent grains or scales. The author considers that the dose of pepsin now employed is probably too small, as one grain is required by the Pharmacopœia to dissolve 50 grains of boiled albumen, and for the digestion of half a pound of beef-steak 80 grains would be necessary. Pepsin should never be given along with alkalies, as is sometimes still done nothwithstanding all warnings to the contrary. [In reference to Dr. Tsheppe's remarks on the quantity of pepsin required, it must be borne in mind that usually the pepsin given to a patient is not intended to do the whole work of digestion, but only to aid the digestive juice already present in the stomach.] (*New Remedies*, Aug. 1883.)

Oil of Birch.—According to H. P. Pettigrew the volatile oil of birch is not identical with the oil of gaultheria or winter-green in that it consists entirely of salicylate of methyl and contains no terpene. The specific gravity of oil of gaultheria is not 1.180 as stated in the United States Pharmacopœia, but 1·0318; the former being the specific gravity of oil of birch, which, as is known, is often indiscriminately sold and employed as oil of gaultheria. [Clinical trials will be necessary to decide whether oil of birch or oil of gaultheria is the better remedy in rheumatism.] (*American Journal of Pharmacy*, August 1883.)

Action of Copaiba on the Urine.—Quincke finds that the addition of hydrochloric acid to the urine of a patient who has taken copaiba causes it to become rose-coloured or purple. This occurs immediately, when the urine is warmed, or at the border between the urine and acid, when they are poured in layers into a test tube. This colouring matter, or copaiba red, as the author terms it, gives three spectroscopic bands—a thin and indistinct one to the left of D, a brighter and darker one in the green, and a broad indistinct one in the blue. When allowed to stand, the copaiba red becomes decomposed and the bands disappear. Nitric acid has a similar action to hydrochloric acid, and concentrated sulphuric acid also produces copaiba red rapidly, but destroys it again quickly. This substance has a number of other reactions, for which we must refer the reader to the author's paper. He considers that the copaiba red is a strong acid. Possibly it is from this substance that a resinous body which appears in the urine is formed. The spectroscopic examination of copaiba red is interfered with by the turbidity which occurs on the addition of acid; but the addition of alcohol causes this to disappear. When copaiba resin is administered instead of the balsam the turbidity in the urine on the addition of acid appears more quickly than after the use of the copaiba oil, but the red colour never appears. It reduces copper on boiling very readily, but does not reduce bismuth. This effect occurs more readily with the resin than with the oil. The author thinks that the spectroscopic detection of copaiba in the urine may be useful as a means of diagnosing cases of doubtful glycosuria. (*Archiv f. exp. Path. u. Pharm.* xvii. p. 273.)

Maté or Paraguay Tea.—Dr. Peckolt has analysed several specimens of maté, and found from ·55 to ·16 per cent. of caffein along with tannin. He considers that the active principles are the same as those of coffee leaves, and in larger amount than in coffee berries. (*Pharmaceutical Journal*, p. 121, No. 686.)

Action of Vegetable Acids on Lead and Tin.—Mr. F. P. Hall finds that vegetable acids dissolve lead, tin and iron, and a tin can containing fruits, &c., is rapidly corroded after it is once opened. The fruits should therefore not be left in the can, but emptied at once after it is opened. (*Pharmaceutical Journal,* p. 124, No. 686.)

The Diagnosis of Gastric Disease.—If we may concur in the teachings of M. Rommelaere, the quantitative estimation of the chemical constituents of the urine may prove of value in the diagnosis of the common forms of gastric disease. In our issue of September 1st, p. 379, we gave an outline of the results at which this physician had arrived up to that period. The number of the *Journal de Médecine de Bruxelles* for September contains some fresh statements in the same direction. A *résumé* of the conclusions arrived at thus far is embodied in the following sentences:—A cancerous ulceration of the stomach is attended with diminution in the amount of urea excreted per diem and also of the urinary chlorides. Simple gastric ulcer is associated with normal-azoturia (if that expression be allowed) or even hyper-azoturia, and the chlorides are of normal amount or in excess. Spreading gastric ulcer is accompanied by normal- or hyper-azoturia, but with decrease in the chlorides of the urine. (*Lancet,* Oct. 27, 1883.)

The Renal Circulation during Fever.—Dr. Walter Mendelson, of New York, in an elaborate experimental research undertaken at the Pathological Institute of the University of Leipzig, the results of which he publishes in the October (1883) number of *The American Journal of the Medical Sciences,* endeavours to determine by experimental methods the actual condition of the circulation in the kidney during fever. He finds:—(1) That in dogs with fever the kidney undergoes a diminution in its bulk; (2) that this diminution is due to a contraction of the walls of the bloodvessels; and, (3) that it is constant and progressive, being proportionate to the intensity of the fever; (4) that it is in all probability the result of a nervous stimulus, originating in the central (cerebral) nervous system from the irritation of abnormally hot blood circulating there. From the intimate relations existing between the arterial pressure and the secretion of the urine, it will at once be evident that many of the changes occurring in the latter during fever may be readily explained by considering the above-named facts. Thus the *decrease in the amount of urine* secreted by fever patients, which has heretofore been ascribed to the increased loss of water through the lungs and skin (and which may amount to one-half, or even a third, of that normally secreted), becomes all the more explicable when the marked contraction is

considered, which he here shows that the renal vessels undergo during fever. For in this case it is immaterial whether we accept the theory of Ludwig and his pupils, that the amount of urine secreted is dependent on the height of the arterial pressure in the kidney, or that of Heidenhain, that it is due to the rapidity of the blood-current in the renal vessels. In either case the great contraction of the kidneys' vessels would produce both a diminished blood-pressure and a retarded current within the organ, and hence a lessened secretion of urine. The occurrence of *alluminuria*, such a constant symptom in nearly all high fevers, becomes readily understood when we bear in mind the extreme anæmia which he finds affects the kidney during a hyperpyrexia. For nearly all authorities are now agreed that albuminuria is due to the glomerular epithelium, in consequence of being insufficiently nourished with arterial blood, losing its function of retaining within the vessels the albuminous portions of the blood plasma. The extreme sensitiveness of the renal epithelium generally to anæmia, whether partial or complete, has been shown by many observers, and it is not surprising, therefore, that in consequence of the prolonged and marked anæmia in the kidneys of feverish individuals, the epithelium should be so profoundly affected as to seriously impair its function, and allow it to become permeable to albumen.

The Tubercle Bacillus.—Opinion is still divided in Vienna as to the significance of the bacillus tuberculosis, but the record of the last meeting of the Medical Society there shows that not every observer in that city has arrived at the same negative conclusions as Spina. For on that occasion a paper was read by Dr. Heitler on the diagnostic and prognostic importance of the tubercle bacillus, in which he maintained that those only could claim to speak with authority who had repeated with every precaution the experiments of Koch. When one has examined, as he had, a large number of individuals, and only found Koch's bacilli in the tuberculous and never in the healthy, when, too, a notable relation is observed between the number of the bacilli and the intensity of the process, one must be convinced that a certain relation exists between the bacilli and tuberculosis. In the debate which ensued Dr. Jaksch mentioned that Dr. Hugo von Frisch, who had examined cases in Prof. Nothnagel's clinic, had arrived at conclusions generally agreeing with those of Dr. Heitler. One case in particular he mentioned where at first no bacilli were found in the sputa. It was a case of chronic pulmonary catarrh with bronchiectasis and secondary pneumothorax; as the case progressed the bacilli were detected, and on post-mortem examination a recent tuberculosis of the

pleura was discovered. Prof. Kundrat reminded the Society of Spina's researches, which showed that bacilli could be found in the sputa of cases of bronchitis, pneumonia, &c. He referred to a case which occurred in the spring in Nothnagel's clinic, where a diagnosis of tuberculosis was based upon the detection of bacilli as well as the clinical signs of bronchiectasis; but post-mortem the case proved to be one of chronic catarrh with bronchiectasis. He also mentioned a case, under Prof. Schrötter, where bacilli were repeatedly found by himself and others, and the necropsy showed only bronchitis and emphysema. Hence he was not disposed to admit that the discovery of bacilli in the sputum was absolutely diagnostic of tubercle. Dr. Jaksch retorted that in one of these cases the observation was faulty, since the vessels employed had not been cleansed, and had been used by others; whereupon Prof. Kundrat rejoined by asking Prof. Schrötter whether in his wards it was customary to change the vessels. Dr. Weichselbaum said that his own observations led him to believe that the bacilli were diagnostic of tuberculosis; and he submitted that doubtful cases should be examined repeatedly and by several observers, since there was a possibility of mistake in confounding the bacilli with other micro-organisms. Thus, with the exception of Prof. Kundrat, no one spoke against the pathognomonic character of Koch's bacillus; and such testimony coming from Vienna, where lately so much stir has been raised on the other side, speaks volumes for the value and importance of the discovery. (*Lancet.* Nov. 10, 1883.)

Role of the Vasomotor Nerves in Œdema.—From experiments made in Cohnheim's laboratory, Jankowski has found, that although paralysis of the vasomotor nerves in one leg, by section of the sciatic nerve, does not cause more lymph to be produced in the leg of a healthy dog; yet in an inflamed limb with paralysed vasomotor nerves much more lymph is produced than in a limb which is also inflamed, but where the vasomotor nerves are intact. A combination of inflammation and vasomotor paralysis produces much greater œdema than inflammation alone, with intact vasomotor nerves. In consequence of this, the œdema on the paralysed side not only appears more quickly and is much greater, but it also lasts much longer. Section of the nerve has no definite or constant influence on the coagulation, colour, or amount of formed material in inflammatory lymph. A watery condition of the blood does not of itself produce any increase in the formation of lymph, nor does it cause œdema, even when the lymphatics of the limb are to a certain extent obstructed. But paralysis of the vasomotor nerves in a hydræmic animal greatly increases

the production of lymph, and is therefore under such conditions a most powerful agent in inducing œdema. [*Practitioner*, xxxi. 177]. (*Virchow's Archiv*, p. 259, vol. 93.)

Action of Opium Alkaloids.—From an investigation conducted under Professor Schmiedeberg in Strasburg, Dr. Von Schroeder comes to the following conclusions:—all the opium alkaloids hitherto examined resemble opium in acting on the same part of the body, viz., the central nervous system. This conclusion holds good only for mammals, and must be qualified in regard to the frog, for in it narcotine, codeine, papaverine, and thebaine have also a paralysing action on the motor ganglia of the heart. These alkaloids agree with morphia not only in the organ they affect but in the nature of their action. The symptoms may be divided into two stages; first, narcosis due to a paralytic action on the brain, followed by—second, tetanus due to increased irritability of the spinal cord. This agreement allows these alkaloids to be united with morphia into one group. Notwithstanding this qualitative agreement between the action of these alkaloids on the one hand and that of morphia on the other, there are considerable quantitative differences in the development and persistence of the narcotic and tetanic stages. The narcosis these alkaloids produce, unlike that of morphia, is not very deep and quickly passes away; in the case of thebaine it occurs in the frog and not only in mammals. The rapid development of the tetanic stage characterises the action of this alkaloid. There is not, as in the case of morphia, a progressive paralysis gradually destroying the functions of the different parts of the brain; the action quickly extends over the whole brain, and remains slight while symptoms of irritation have already begun. This fact renders it advisable to break up the group of opium alkaloids into two sub-groups, the first of which may be called the morphine group, characterised by the prominence of the narcotic stage, while in the other, which may be called the codeine group, the tetanic stage is more prominent, and the narcosis less so. The members of these groups may be arranged as follows, so that each subsequent member has a weaker narcotic, and in the codeine group, has, at the same time, a stronger irritant action. In the morphine group oxydimorphine, in the codeine group papaverine, codeine, narcotine, thebaine. The codeine group contains also hydrocotarin, laudanosin, and cryptopin; but at present we know too little about them to assign a place in the group to them with certainty. The same may be said of codethyline. The codeine group becomes closely allied by its last members with the strychnine group. The members of the codeine group should not be used therapeutically for their narcotic action. In the

codeines produced from morphia by the addition of alcohol radicals such as codethyline $C_{17}H_{13}NO_2(OC_2H_5)$ obtained from morphine by the introduction of ethyl, the narcotic action is diminished, whilst the convulsive action is increased in proportion to the number of atoms of hydrogen substituted by alcoholic radicals. In the alkaloids produced from morphine by oxidation (oxydimorphine and oxymorphine), their narcotic action is diminished, without the convulsant action being increased; narceine has no apparent physiological action. (*Archiv f. exper. Path. und Pharm.* p. 96, vol. xvii.)

Action of Atropine and Copper on the Frog's Heart.—From experiments on this subject made by Harnack and Hafemann they conclude that minimal doses of atropine which are just sufficient to paralyse the inhibitory centres in the heart, have no other action on the heart besides. The doses required to produce any other action is at least four times as great as those just mentioned. We have therefore in small doses of atropine a perfectly certain means of abolishing the effect of the inhibitory nerves on the heart without altering it in any other way whatever. Large doses of atropine paralyse the heart itself. The paralysis is sometimes preceded by alterations in the cardiac action, which indicate a stimulating action of the drug. This action however is feeble and inconstant and is not much stronger than that of a 1 per cent. salt solution. Such doses of atropine will sometimes produce feeble and irregular contraction for a short time in a paralysed heart when its irritability is not completely abolished. There is no comparison, however, between this appearance and the abolition of the stand-still produced by muscarine by a minute dose of atropine. The diastolic stand-still caused by iodal which acts by paralysing the muscular fibre is not removed by atropine. Atropine therefore affords a certain means of distinguishing the cause of stand-still of the heart in diastole. There is no resemblance between the action of atropine and the specific stimulant action which physostigmine produces not only on the muscles of the heart but on the muscles generally. Physostigmine abolishes all kinds of diastolic stand-still of the heart, so that powerful pulsations again occur so long as the cardiac muscle retains its irritability. Physostigmine increases the contractility of the cardiac muscle and all the appearances which are observed in the heart are due to this alteration; more especially an incomplete systolic stand-still of the ventricle is observed which has, however, a perfectly different character from that produced by digitaline. At the same time that the contractility of the cardiac muscle is increased, the maximum work which the heart can do diminishes somewhat. Double salts of copper in not too large doses act as powerful irritants before

paralysing the cardiac muscle. In this action they agree with many other substances, such as the salts of potassium and the members of the chloral group. The action is much greater than the corresponding one of atropine, and the heart in this respect resembles the skeletal muscles in which double salts of copper produce marked fibrillary twitchings before paralysing them. The ends of the vagus in the heart are not paralysed by double salts of copper. (*Archiv für exper. Path. und Pharm.* p. 145, vol. xvii.)

Absorptive Power of the Skin.—From experiments made with salicylic acid, salicylate of sodium, and tincture of iodine applied to the skin as simple solutions or in the form of spray and with mercurial ointment, Dr. Ritter comes to the conclusion that the normal skin has not the power of absorbing these substances either in a fluid condition or in the form of ointment or of spray, but that all substances which irritate the skin may produce when sufficiently vigorously applied a solution of continuity and may then be absorbed from the altered skin. (*Deut. Archiv f. klin. Med.* p. 143, vol. xxxiv.)

Alterations in the Cord due to Arsenic, Lead, and Mercury.—Dr. Podow has made some experiments on this subject which have led to the following results. In acute poisoning with arsenic, lead, and mercury, marked alterations occur in the spinal cord having the character of acute central myelitis. When the poisoning is comparatively slow, these changes are not limited to the grey substance alone, but affect the white substance also, and present the characters of diffuse myelitis. The peripheral nervous system is completely unaltered in rapid poisoning by these substances. The clinical nervous symptoms observed in rapid poisoning, convulsions, paralysis, pain and anæsthæsia are explained by the alterations just described, and none of these symptoms can be explained by any peripheral nervous affection. (*Virchow's Archiv*, p. 39, vol. 93.)

Notes and Queries.

Hewlitt's Liquor Ergotæ Purificatus.—Some time ago we received this preparation from Messrs. Hewlitt and Son, but we have not noticed it until we were able to have it partially at least tested. The chemistry of ergot is so difficult that an ordinary chemical analysis of such a preparation as this gives no information regarding its activity as a remedy. Preparations of ergot differ from other drugs also in the absolute necessity which exists for their trustworthiness. Imperfection or inefficiency in another remedy might have no further consequence than a little inconvenience to the patient, perhaps a somewhat less rapid recovery, but the life or death of a patient very frequently depends on the activity of a preparation of ergot. We regret that we have been unable to get this preparation tried in midwifery practice, but we have tried it ourselves in a number of cases of hæmoptysis, with such satisfactory results that we have little doubt it will prove a trustworthy preparation in other cases also.

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Department of Public Health.

AN EPIDEMIC OF TRICHINOSIS.

ONE of the most extensive and fatal outbreaks of trichinosis in recent years has lately occurred in the district of Magdeburg. The epidemic proportions assumed in this instance by the disease have been the subject of careful investigation by Dr. Joesting of Halberstadt, who contributes an account of his inquiry to the December number of the *Centralblatt für allgemeine Gesundheitspflege.* His report presents several features of interest.

It appears that the flesh of an undoubtedly trichinous pig, which had been slaughtered on the 15th of September last at the little town of Emersleben, was disposed of on that and the following day in Emersleben and neighbouring villages. According to universal custom in Saxony nearly the whole of the flesh was eaten in a raw state as minced meat.

The earliest cases of illness showed themselves in Emersleben on the 18th of September, and by the 28th of the month the disease was prevalent throughout the place.

The first symptoms noticeable in the cases were violent diarrhœa and marked loss of strength. The persons first attacked were the family of the butcher who killed the pig, no member of which escaped. The disease was at once recognised to be trichinosis, and upon further inquiry it was ascertained that in every instance pork obtained from the same source had been partaken of in a raw or green-smoked state previous to illness.

The epidemic continued to augment in numbers until the beginning of October, when also the first fatal case occurred. On

examining the muscles of the body numerous trichinæ were discovered, and enormous numbers were present in the contents of the intestine, every preparation of the intestinal mucus disclosing from ten to fifteen trichinæ within a field of the magnitude of a small lentil.

In subsequent deaths microscopic examination revealed similar results; the numbers of trichinæ in the muscles being less remarkable, however, than the swarms which, including adult forms, were always present in the intestine.

Up to November 11th there had occurred in Emersleben (a place of 900 inhabitants), 240; in Deesdorf (with 400 inhabitants), 40; in Nieuhagen, 70; and in the remaining localities affected 11; in all 361 cases of trichinosis, and of these 57 had proved fatal, including 45 deaths in Emersleben and 10 in Deesdorf.

The question as to whether the flesh had been examined before sale by the public official (*Fleischbeschauer*) appointed for the purpose in accordance with the State enactment of 12th December, 1865, is decidedly negatived by the whole of the circumstantial evidence of the case. The animal must, beyond a doubt, have been so infected by trichinæ that these could not have escaped the most superficial examination. Besides, it so happened that the culpability in this respect of the inspector for Emersleben had but a short time previously been satisfactorily tested by Dr. Joesting. Clearly, therefore, either the butcher or the inspector was culpable.

Some insight is afforded by Dr. Joesting's remarks as to the thoroughly illusory nature of the supervision exercised, professedly under State control, for the prevention of the sale of trichinous pig-flesh. By the terms of the enactment referred to the inspector is entitled to a fee of one mark (a shilling) for each examination, but most commonly a bargain is struck whereby he receives much less than this, half a mark, or even so little as threepence—a usual payment. In the case of the particular functionary at Emersleben it transpired that he had agreed with the butcher in question to undertake the examination of between 180 and 200 pigs, which the latter killed yearly, for the sum of thirty-six marks, or actually less than threepence a head.

It need hardly be pointed out that a microscopical examination conducted under such arrangements is not likely to be otherwise than perfunctorily made, if made at all.

But any remaining faith in this supervision, apart from the question of its practicability, under any circumstances, must be abandoned when it is known that, whether from incompetency or negligence, the results of such examination when made are frequently quite untrustworthy. We have personal knowledge of, such customs in other parts of Germany, and Dr. Joesting cites one which came recently under his notice, in which trichinosis broke out in a family after pork had been partaken of, which had been certified as free from trichinæ by the inspector. Trichinæ were subsequently found in the remaining portions in every section prepared from them. From these and other considerations touching the possibility of trichinæ being always found when present, it is manifestly certain that the taste for raw pig-flesh in any form cannot be indulged with impunity. But the reluctance with which it is likely to be given up is perhaps best shown in the disinclination on the part of a large proportion of the German public, extending even to the well-educated classes, to attribute to its true cause illness which beyond a doubt is trichinosis. We have more than once encountered this disbelief even in professional coteries, when the indulgence was invariably defended by the remark that the cooking of ham as practised in England destroyed all delicacy of flavour. This may be so.

And the something more than indifference with which the condition of such food is regarded by some of these votaries may perhaps be not exaggeratedly illustrated by the following incident recounted by a friend to whom it occurred on the occasion of a holiday ramble in the Rhineland. Dining at a certain well-known hotel, his attention was directed by his companion in travel to the thin slices of this luxury—raw ham—which had just been handed round, and upon which he then perceived minute attenuated parasites of a disagreeably ascaroid-looking type. Drawing in turn the attention of a German lady next him, with whom he had been conversing, to this state of things, which had altogether escaped observation by the other guests, he expected some expression of horror and disgust to follow.

But beyond returning a look of mingled amusement and surprise, she merely replied, "Nur Maden-würmchen" (only mites), and went on. But our friend's penchant for raw ham received its *coup de grâce.*

The thorough cooking of all pig-flesh has been lately laid down in a memorandum issued to the sanitary authorities of England drawn up by the Medical Officer of the Local Government Board as the only practicable security against trichinous disease. This memorandum is not undeserving the careful consideration of the German Imperial Board of Health, as affording in its simple directions a measure of security against danger to health, for which the official *Fleischbeschau* has over and over again been demonstrated a delusion and a sham.

THE REGULATION OF TENEMENT HOUSES.

The attention which has lately been drawn to the conditions under which the poor are housed both in the metropolis and other large centres of population has resulted in a declaration by the Local Government Board that the enactments contained in section 35 of the Sanitary Act, 1866, and section 47 of the Sanitary Law Amendment Act, 1874, shall hereafter be in force in each of the parishes and districts of the metropolis in which those provisions are not in operation; and also in the issue by the Board of certain memoranda to the provincial urban sanitary authorities pointing out to them the extent of the powers which they possess in the matter of the dwellings of the labouring classes and urging upon them action with regard to any such dwellings within their district, as are not in a proper sanitary condition. As regards the metropolis the necessary notice was published in the *London Gazette* of the 28th of December, 1883.

It is curious to note that the principal powers to which attention is now drawn have vested in the authorities to whom they are applicable ever since the passing of the Sanitary Act

of 1866, for the Sanitary Law Amendment Act, 1874, made but trivial alteration in so far as the actual powers of authorities are concerned, although it gave the Local Government Board the power to put the necessary sections in force in the metropolis, without any such application on the part of the sanitary authorities as was necessary under the Sanitary Act of 1866. During all these seventeen years, however, nothing worthy of the name has been done by the sanitary authorities in London as regards "houses let in lodgings, or occupied by members of more than one family," that is to say, as regards the so-called tenement houses to which the sections in question have reference.

The actual powers conferred under these Acts enable the authorities to make important regulations as to health and decency. Thus, under the Sanitary Act, 1866, regulations may be made:—1st. For fixing the number of persons who may occupy a house or part of a house, which is let in lodgings or occupied by members of more than one family. 2nd. For the registration of houses, thus let or occupied in lodgings. 3rd. For their inspection and keeping the same in a cleanly and wholesome state. 4th. For enforcing therein the provision of privy accommodation and other appliances and means of cleanliness in proportion to the number of lodgings and occupiers, and the cleansing and ventilation of the common passages and staircases. 5th. For the cleansing and lime-whiting, at stated times, of such premises. Under the Sanitary Law Amendment Act, 1874, regulations are made to extend to the ventilation of rooms, paving and drainage, the separation of the sexes, &c. With such powers as these it might have been assumed that much would have been done to remedy the grave evils which were brought under the notice of the public by means of a conference held at the Rooms of the Society of Arts last summer as to the need for action as to tenement houses, and still more forcibly, since that date, by the publication of the notable pamphlet *The Bitter Cry of Outcast London,* and of Mr. G. R. Sims's work on *How the Poor Live.*

What has really been needed has been the compilation of codes of bye-laws as to these matters, as also their enforcement by the several sanitary authorities. Several circumstances

have tended to hinder this being done. In the first place—and this was pointed out by one of the metropolitan medical officers of health who attended the conference which has been adverted to—there are on some of the London vestries the very men, "tenement-mongers," who either themselves hold, or who have an interest in, the class of houses to which the regulations should apply; and it has been well known to them that any such registration and inspection as would have followed, would have exposed them as owners of such property, and also that compliance with the regulations, when made, would have seriously interfered with the large profits which are but too often made out of such tenements. Then again, there was the question of expense; for it would be quite useless to make the needed bye-laws and regulations, unless a number of inspectors were appointed to investigate the circumstances under which the houses are tenanted, to report as to the improvements and alterations needed, and to see both that these were carried out, and that conditions of over-crowding, &c., were prevented and did not recur. The fear of this expense has, we believe, been a principal stumbling-block. And once more, there was the need of such a code of bye-laws as could be effectually put into operation. Some of the London vestries did, as a matter of fact, draw up certain bye-laws as to these houses, but when an attempt was made to carry them out, it was found that they were in several important respects insufficient to secure the ends that had been held in view, and also that some of the clauses on which most reliance was placed, were in excess of the powers conferred by the Acts under which they were made, and hence that they could not be enforced. The result was that for one reason or another, bye-laws which had been made were allowed to become a dead letter, and sanitary authorities who had not even troubled to make any, left matters precisely where they always had been.

But there still remained the power which is given to the Local Government Board, under the Sanitary Law Amendment Act, 1874, themselves to declare the sections in force—a power which, we may add, is equally given to that Board, as regards all the extra-metropolitan sanitary districts in England and Wales, under section ninety of the Public Health Act, 1875. Why was

this power never exercised as regards the metropolis? This question it would be extremely difficult to answer satisfactorily, but there are certain considerations which may have influenced the central authority in the matter. It is true that whenever the sections have been declared in the *London Gazette* to be in force within any district, the Local Government Board are themselves empowered to make the necessary bye-laws, but the law is silent on the question of the appointment of the requisite staff to see to their enforcement, and since by the failure to make any such appointments, any lukewarm or unwilling authority could defeat the intentions of the legislature, it becomes evident that something more was wanted than the mere intervention of the Local Government Board. That which was needed has now been provided in the shape of a strongly-expressed public opinion, and hence the action which has now been taken has a better prospect of success than has at any former period been the case.

The want of adequate bye-laws has also been met. It is now some years since the Local Government Board issued, as a part of their model code, a series of bye-laws relating to tenement houses, and some districts in the provinces have already adopted them. They needed but little modification to adapt them to the sanitary and other requirements of London, and they have now, after slight alteration, been submitted to all the vestries as the basis on which the several authorities are asked to frame the needed codes for their respective districts. It is to be hoped that the model issued will not be materially altered, for it has evidently been prepared with much care, and it is extremely desirable that there should be, as far as possible, uniformity in the regulations in the different portions of the metropolis. Examination of the bye-laws shows that as regards one point, namely, the separation of the sexes, no regulation has been drawn up. This, it is understood, is owing to the great difficulty which was experienced in the attempt to frame any restrictions which could be insisted on, in the case of tenement houses where the occupants of any one room will be members of the same family; and hence the only effort made in this direction is to require under the bye-laws that a statement shall be furnished to the proper authority stating the number, age, and sex of the occupants of each room used for sleeping. The matter is widely

different in the case of common lodging houses, in which the same room is almost invariably occupied by members of different families.

One of the clauses which will probably present the greatest difficulty, is that in which are specified the conditions under which certain houses sub-let in tenements will be exempt from the operation of the bye-laws. Strictly speaking, every house in which a room is let off comes within the terms of the sections relating to tenement houses, and it is evident that, in the metropolis especially, where chamber residences are by no means uncommon, a large number of dwellings which neither need to be subject to periodic inspection or to special regulations would, apart from an exemption clause, be brought within the scope of the bye-laws. In some districts the sub-let houses are small ones, and it suffices to exempt all houses above a certain rateable value, but in the metropolis this is by no means the case, some of the worst tenement houses being large and very highly rated. The rent paid by each lodger for a room or rooms, furnished or unfurnished, affords, however, a better test; and hence it will be for each sanitary authority to specify in an exemption clause, both the amount of rateable value for the entire house, and the amount of rent paid by any individual tenant which, taken together, should free the house from the operation of the bye-laws.

But quite irrespective of the powers we have thus far referred to as to the control and sanitary regulation of this special class of house property, the attention of the vestries has been drawn to a number of other Acts under which they have important powers for dealing with the present condition of the houses occupied by the poorer classes. Thus, under the Acts relating to the removal of nuisances much may be done, as the result of regular and systematic inspection, to deal with conditions which are either a nuisance or injurious to health; and it is important to remember that the word "nuisance" includes any house or part of a house so over-crowded as to be dangerous or prejudicial to the health of the inmates. Then there are the Artisans' Dwellings Acts, 1868 to 1882, generally known as Mr. Torrens's Acts. The primary object of these Acts is to secure the improvement or demolition of houses which are in a state dangerous to health so as to be unfit for human

habitation, but they also give numerous other powers to sanitary authorities. The machinery of these Acts has, in several respects, been found to be both clumsy and expensive, and this is doubtless one of the principal reasons why more of the work they were intended to secure has not been carried out under them. Another set of Acts relating to this subject is known as the Artisans' and Labourers' Dwellings Improvement Acts, 1875 to 1882, or Sir Richard Cross's Acts, the duty of carrying out which is imposed, not on the sanitary authorities, but on the Metropolitan Board of Works in all parts of the metropolis except the city. But it devolves on the medical officers of health to the vestries and district boards to make the official representations on which the various improvement schemes are based; these improvements, including the demolition of houses, courts, and alleys which by reason of want of light, air, ventilation, or of proper conveniences, are either unfit for human habitation or are the cause of habitual prevalences of fever and other diseases, as also the re-construction of such areas as are demolished in such a way as to make provision for the working classes who have been displaced. It must, however, be admitted that, for various reasons, much less has been found possible under these Acts than was anticipated when they were passed.

One other set of Acts deserves notice, namely, the Labouring Classes' Lodging Houses Act, 1851, and the Labouring Classes' Dwelling Houses Acts, 1866 and 1867. Under these Acts important powers in connexion with the provision of lodging houses and dwellings for the poor have long been in operation. The Acts apply to any parish having a population of not less than 10,000 persons, or to any two or more neighbouring parishes having at the date of the last census an aggregate population of not less than 10,000 persons. They can be adopted by the vestries and put into force by a Secretary of State as the result of an application based upon a decision of a public parish meeting, and when once in operation the vestry has to appoint from three to seven persons, being ratepayers, to act as commissioners in the execution of the provisions of the Acts. These commissioners can then appropriate for the purposes of the Acts any lands vested in the sanitary authorities whom they represent, they may contract for renting land, and

they may otherwise acquire sites. The land being obtained, they may erect buildings suitable for lodging houses for the labouring classes, they may convert existing buildings into lodging houses, and they may alter, repair, and improve the buildings, and may even fit and furnish them with all requisite conveniences. They may also, subject to certain conditions, acquire existing lodging houses either by purchase or by taking them on lease, and they may themselves undertake the management of such houses, appointing the necessary staff, and enforcing the necessary requirements by means of bye-laws. And not only so, but loans can be obtained from the Public Works Loan Commissioners for the purpose of assisting in the purchase of lands and the erection of buildings, and advances of money can be made on mortgage, provided that all sums advanced are repaid within a period which shall not exceed forty years, the rate of interest being not less than four per cent. The powers contained in these latter Acts are most important, and yet we cannot recall a single instance in which any real effort has been made under them to provide proper dwelling accommodation for the poor. For a period varying from twenty-two to sixteen years these Acts appear to have been lying almost, if not absolutely, dormant.

It will thus be seen that the action which the Local Government Board have taken in this matter has been to remind the vestries and district boards of the large powers which are already vested in them for dealing with insanitary dwellings of the labouring classes, and for providing, under different methods, such improved and increased dwelling accommodation as has become necessary. Any clamour for new legislation seems entirely out of place until there has been a vigorous exercise of the powers already entrusted to our sanitary authorities. If the existing law is insufficient to deal with the question at issue, the sooner it is known in what respects amendment is needed, the better it will be. But in the meantime it would appear that such powers are available as to make it quite unnecessary to talk of state-subvention and similar innovations. The public are at the present moment fully alive to the necessity of dealing with the social necessities both of London and of our large towns, and the occasion is an opportune one for inau-

gurating a new system as regards the dwellings of the poor. Nothing, however, but a commencement can be made during the short period for which the present excitement may be expected to last; and it cannot be too clearly understood that no sudden and drastic measures can lead to the elevation of the "outcast poor." But, if future work be now initiated on sound principles, and if the sanitary authorities can be induced steadily and systematically to carry out and to enforce the provisions of the existing law, much may be done to secure permanent improvement in the sanitary and social conditions under which our poor live.

Hitherto we have referred almost exclusively to the metropolis, but since the issue of the official circulars to the London vestries and district boards, communications have also been addressed by the Local Government Board to the urban sanitary authorities in the provinces, and the several provisions to which their attention is directed are in the main those to which we have adverted in connexion with the metropolis. The sanitary action needed, has, however, to be taken under the Public Health Act, 1875, instead of under the Nuisances Removal Act and the Sanitary Acts of 1866 and 1874; and as regards towns having a less population than 25,000, no action can be taken under Sir Richard Cross's Acts. There remain, however, the extremely important provisions of the Artisans' Dwellings Acts, 1868 to 1882, as also those of the Labouring Classes' Lodging Houses and Dwellings Acts. There attaches to the possession of such powers a grave responsibility, and we trust that this will be so felt as to lead to definite action on the part of those to whom they have been entrusted by the legislature.

HIGH AND LOW CEILINGS.

In a recent report to the Court of Common Council, Dr. Sedgwick Saunders has raised a protest against the erection in Petticoat Square of certain artisans' buildings, on the ground that all the rooms above the ground floor are only eight feet in height. He shows, by reference to a number of similar buildings, that the general average height of rooms in modern blocks for working men is nine feet; that they vary from about ten feet on the ground floor to eight feet seven inches on the fifth and sixth stories; and he urges, on the ground of health, that every room occupied by the working classes should be at least nine feet, and preferably ten feet, in height. On the other hand, Mr. John Honeyman recently read a paper before the Congress of the Sanitary Institute at Glasgow, in which he stated that there were distinct advantages in having low ceilings. Mr. Honeyman asserts that where land is dear and the demand for dwelling accommodation great, the builder will naturally be tempted to make stories low, and thus to increase their number, instead of constructing buildings of a few high stories; and that in this way an increased number of tenements can be provided at a reasonable cost, a method of procedure which of all others tends to the prevention of over-crowding. He further asserts that, with the appliances which alone are available in the tenement of the working man, it is far easier to ventilate a low room than a lofty one; that if a room be low in proportion to its area, it will be better ventilated by the fireplace and doorway, than if a space of stagnant air be provided at an elevation above the reach of such means of ventilation; and that high rooms mean a wasteful expenditure of money, with consequent increase of rent, which encourages, in the most direct manner, over-crowding with all its attendant evils. He also states that there is no necessary connexion between density of population and a high death-rate, as the statistics compiled concerning the inmates of various improved dwellings show.

Both authorities whom we have quoted have, we believe, precisely the same object in view, and yet they desire to attain it by means which are diametrically opposed to each other. There is much in what Mr. Honeyman asserts, and, provided a certain cubic capacity per occupant could always be insisted on, it would be better that it should include the comparatively large amount of floor area which would be necessary in the case of a room eight feet in height, than that it should be partly contained in the higher strata of a room ten feet in height, with a corresponding diminution of floor-space. It will probably be found impossible, in the present state of public opinion, to require much more than 400 cubic feet for each adult, and half that amount for children under ten years of age, even in the case of a sleeping apartment which is not exclusively used for that purpose, and this minimum capacity must be regarded as utterly insufficient, unless we have along with it a constant and rapid change of air. "But," to quote Mr. Honeyman, "to effect this change so that the whole volume shall be kept up to a safe standard of purity, it is necessary that the fresh air should be properly distributed, and permeate the whole apartment. This point, we fear, is sometimes lost sight of. For example, if we take a room of 2,000 cubic feet with five inmates; to keep the air, not as pure as we could wish, but in a tolerably healthy condition, at least 5,000 cubic feet of fresh air would require to be passed through the room per hour; and as an ordinary open fire will easily attract that quantity, there seems to be no great difficulty about it. But observe, it is quite possible to pass all that quantity through the room without purifying the atmosphere in any appreciable degree; we may let it all in at one side of the room and up the chimney at the other, leaving the air breathed by the inmates impure and poisonous, perhaps fatally; so that the more complete the distribution of fresh air, the more beneficial will the ventilation be. Now, the facility of distribution will depend, to a large extent, on the form of the room. If the room (always bearing in mind that we are speaking of rooms of the same cubic capacity) be high in proportion to its area, and the fresh air be admitted in the usual way referred to, the lower part only will be ventilated, and a large proportion of its atmosphere will remain impure; whereas

if it be low in proportion to its area, it will all be well ventilated and the inmates will get the full benefit of the room's capacity. In the other case they would not, as a considerable proportion of the high room would remain stagnant and foul—a condition objectionable on other grounds."

Having regard to the actual circumstances associated with the housing of the poor, we are inclined to think that some excess on eight feet is desirable, and we are certainly not convinced by mortality statistics compiled as regards the occupants of model dwellings. These dwellings in London, if not elsewhere, contain a very artificial population, consisting mainly of artisans and other workmen at the prime of life, together with their families who are well fed and well clothed ; indeed the really poor, the old, and the needy cannot afford to live in such dwellings ; and these circumstances alone suffice to vitiate any inferences drawn from statistics as to mortality or sickness amongst those who live in these tenements. On the other hand, a room ten feet high seems hardly necessary, and the moment an increase in height tends, whether by adding to rent or otherwise, to bring about over-crowding, or to render it so difficult to warm a room that the ordinary means of ventilation are blocked up by the occupants, then the reasonable limit of height has been reached. We should be sorry to see all the rooms of the working classes limited to a height of eight feet, but we could hardly advocate a uniform height of ten feet, or even of nine feet. Indeed, the actual height which is best can hardly be settled without reference to floor area and to the means of ventilation available.

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Original Communications.

HISTOLOGICAL LESIONS OF THE KIDNEY IN ALBUMINOUS NEPHRITIS.

BY DR. V. CORNIL,

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(*Continued from* p. 90.)

ANOTHER cause of nephritis, cantharidine, acts through inflammation affecting more especially the connective tissues of the organ. This I observed three years ago in dogs slowly poisoned by this substance. Recently Aufrecht has announced, in the *Centralblatt f. d. med. Wiss.*, that he has produced typical interstitial nephritis by slow poisoning with cantharidine in rabbits.

Interstitial nephritis is also the final result of the experiments in which infarcts are produced in the kidney by means of emboli introduced into the arterial circulation.

Infarcts of the kidney, as studied in man at different periods of their evolution, present also lesions which resemble the results of experiment, and which it will be well here to give in detail, for it shows us the succession of phenomena in nephritis affecting first the epithelium and finally the connective tissue. Infarcts of the kidney are the consequence of an embolism which has lodged in the renal artery and has arrested the circulation in a whole district of the organ. These

emboli come from the heart, from the aorta, or from the renal artery, and consist of a fragment of fibrin with or without *débris* from the heart or an artery affected by endocarditis or endoarteritis. The circulation is arrested in the whole portion of the kidney to which the obliterated artery is distributed. The capillary vessels of all this region are filled with blood, so that the infarct at first is of a reddish-brown colour and generally projects from the surface of the kidney. Its form is generally that of a cone, the base being towards the surface of the kidney and the summit corresponding to the point at which the artery is obliterated. Later on the whole infarct becomes of an orange or yellowish colour and opaque. On microscopic examination the capillaries are seen quite filled with blood in a state of disintegration, the detritus being of an albuminous, fatty, or pigmentary nature. The pigment, due to the destruction of the red corpuscles, is brownish or red. The epithelial cells of the tubules are swollen and granular, and also exhibit fatty granulations. Soon the infarct diminishes in size and becomes depressed, and is characterised by a superficial depression preserving its yellow colour and its opacity. This is the lesion which Rayer has described under the name of rheumatic nephritis. The cup-like depression of the infarct, which is nothing but a necrosed portion of the kidney, coincides with granulo-fatty degeneration accompanied by desiccation. Already re-absorption of the albuminous or fatty granules which result from this necrosis has commenced, as is proved by examination of the uriniferous tubules situated at the limit of the infarct.

The circulation is there more active than in the normal condition, and the necrosed region is surrounded by a zone of hyperæmic tissue. The cells of the uriniferous tubules, when examined in sections hardened with osmic acid, are swollen and vesicular. The protoplasm at the side next to the membrana propria of the tubule is granular and opaque, and exhibits some fatty granules. The nucleus of the cells is normal, but all that part of the protoplasm which joins the lumen of the tubule is liquid, clear, vesicular-looking, projecting, and containing fatty granules in suspension. The contents of the enlarged lumen of the tubules consist of an exudation which contains hyaline or

colloid spherules and fat. From these facts, noted at a given period of the resolution of renal infarct, it appears evident that absorption is not effected only by the circulation in the blood-vessels and lymphatics, but that the uriniferous tubules also take part in the result; the living epithelial cells absorb a part of the molecular detritus which results from the mortification or necrosis, and throw it by virtue of their peculiar mode of secretion into the lumen of the uriniferous tubules, whence it passes into the urine. This mode of absorption is of course very slow. Little by little the renal tissue which is the seat of the infarct clears itself. The granular substance which results from the destruction of the cells is eliminated, but the fibrinous framework remains and contracts, the cavities of the tubules diminishing in size as their contents are eliminated. Subsequently to this process elements of new formation appear in the thickened connective tissue which surrounds the contracted infarct. New vessels penetrate it, and in the infarct itself and all around it a connective tissue is slowly formed, which becomes organised and fibrous, and forms a veritable cicatrix due to interstitial nephritis.

We see then these old infarcts replaced on the surface of the kidney by a depressed and fibrous cicatrix covered over by the true capsule, which is itself more or less thickened and covered on its external surface by cellulo-fatty tissue which fills up the loss of substance in the kidney. In the portion of cortical substance which has originally been the seat of the infarct, we still find on section traces of the structure of the kidney, *i.e.* glomeruli which are atrophied and fibrous and reduced to a small nodule of connective tissue, and uriniferous tubules of small diameter and covered by a single layer of small cubical embryonic cells, nucleated and without differentiated protoplasm; a thick connective tissue containing small round or ovoid cells around these elements; tubules and vessels of the glomeruli. We have to do here then with a nucleus of interstitial nephritis.

Thus the arrest of circulation in a limited lobule of the kidney determines mortification without putrefaction, and a degeneration of the cells followed by their absorption, and a chronic inflammation with a fibrous contraction of tissue.

M 2

Interstitial Nephritis in Man.

Cardiac Kidney.—Certain alterations of the kidney resemble those which we observe in interstitial nephritis, although it will not do to carry the analogy too far.

Thus in the kidney which is called the cardiac kidney the cortical and the medullary substance are congested; on section the organ is hard, and the finger-nail can with difficulty be forced into the parenchyma.

On microscopic examination we find that the connective tissue is slightly thickened around the vessels and some of the tubes of the cortical substance, but the chief lesion is dilatation of the capillaries. This dilatation extends to all the pyramids, and also affects a certain number of the glomeruli. I ought to add that in some tubes only is there fatty degeneration, and sometimes bloody infiltration of some of the cells.

The cardiac kidney is not often accompanied by albumen in the urine, excepting occasionally when some additional congestion occurs near the termination of the case.

All these circumstances make it difficult to place the lesions of the cardiac kidney beside those of Bright's disease properly so called, and still less can they be classed with the alterations of true interstitial nephritis.

Interstitial Nephritis Proper—Renal Cirrhosis.

In typical interstitial nephritis we find the cortical substance covered on the surface by fine projecting granules, which are sometimes larger and rounded.

We sometimes also meet with granulations alternately small and large in the same kidney. At the bottom of the depressions bounded by the large granules there are generally small granulations. The granules are surrounded as a rule by capillary vessels or by veins dilated with blood (stellæ of Verheyen).

The capsule adheres very closely to the renal substance; some effort is required to detach it, and when it is torn away it always carries along with it some small pieces of the renal substance.

One has only in fact to scrape the internal surface of the

capsule and to examine the scrapings under the microscope in order to recognise the elements of the cortical substance, tubes and glomeruli completely isolated and fibrous. In a longitudinal section passing through the axis of the pyramids we notice an atrophy more or less marked, sometimes well pronounced in the cortical substance, while on the contrary the substance of the pyramid retains nearly its normal size.

The colour of the kidneys is generally reddish, but it may be grey, yellowish-grey, or yellow. These varieties of colour depend upon a greater or less degree of congestion in the surface and on granulo-fatty alterations of the epithelial cells. The granules in fact may be either pale and transparent, or yellow and opaque.

Finally, there is a characteristic which we may say is never wanting, and this is that the finger-nail can with difficulty penetrate the cortical substance.

In describing the lesions of the kidney due to interstitial nephritis[1] more in detail, we must distinguish between what happens in the uriniferous tubules and in the vessels. In regard to the glomerulus, we notice at first a thickening of the capsule itself. The cells of the capsule proliferate, and all around it in certain cases an accumulation of small cells occurs. In regard to the vascular tuft, the loops become agglutinated to one another; the walls of the capillaries become thicker, the lumen becomes impermeable to blood, and the glomerulus finishes by contracting; frequently between the capsule and the glomerulus there is tolerably an abundant colloid substance. When we break up the kidney we find fragments of Bowman's capsule with broken pieces of vessels, which are already fibrous and surrounded with round cells, sticking to it.

The completely fibrous glomerulus no longer contains cellular elements; it may undergo a calcareous degeneration, and the opaque granules which adhere to the atrophied vascular loops effervesce on the addition of dilute hydrochloric or even acetic acid.

All around the glomeruli there is a large quantity of atrophied

[1] We do not speak here of certain forms of interstitial nephritis which are quite special or local like those observed in tuberculosis of the kidney, leucocythæmia, tumours, &c.

uriniferous tubules. The central part of the pyramid of Ferrein on the contrary is dilated and projects on the surface of the kidney. The tubules of this central part, generally much dilated, exhibit a line formed of flattened or cubical cells, and almost transparent. We frequently find in this epithelial covering some vesicular cells resembling those which we have previously described. The cavity of the tubules is occupied by colloid spherules, by reticulated exudation, or colloid exudation.

On a longitudinal section of the kidney we see that the connective tissue forms thick bands limiting the groups of dilated tubules, and situated at either side of the pyramids of Ferrein. The tubules at the base of these pyramids are wavy and irregularly twisted upon themselves. On the other hand, in the bands of connective tissue we find extremely small tubules with very thick walls. It is in these bands also that we find the glomeruli and the atrophied part of the convoluted tubules.

The atrophied uriniferous tubules are seated in the middle of the connective tissue containing round or ovoid cells, or even flattened cells. This tissue forms thick trabeculæ round the vessels, and especially of the arterioles and venules. The trabeculæ which surround the atrophied tubules are more or less thickened. In the interior of the atrophied tubules, whether they be contorted tubules of the cortical substance or straight tubules, the cellular investment is always formed of small cubical or pavement cells, in fact of indifferent cells. In the centre of the lumen these tubules frequently contain hyaline or colloid cylinders. They are often, so to speak, choked up by them. Then the epithelial cells investing the tubule become sometimes flattened in consequence of the compression which is exercised by colloid cylinders contained in the lumen of the tubule. At other times we find, as Rindfleisch has figured, two layers of epithelial cells, the external one cubical or flattened with a granular protoplasm and nuclei, and a second inner layer presenting mucous contents and a vascular aspect, and secreting mucous or colloid substance which fills the lumen of the tubules.

The varieties of renal lesions in interstitial nephritis are very numerous, and I will content myself with indicating the chief of them.

We sometimes find very small kidneys the surface of which presents a gelatinous aspect. When we look at them more closely we see that this appearance is due to the presence of a considerable number of small transparent projections, resembling small miliary vesicles. But on microscopic examination we see that each of these small projections is due to a microscopic cyst with colloid contents. The centre of the colloid coagulation is often deeper than the periphery, which presents stratifications and concentric layers. These microscopic cysts with colloid contents are developed in the interior of uriniferous tubules which have been strangulated in a moniliform manner. The membrane of the tubules which forms the external walls of the cysts is covered by a uniform layer of flat cells, which are sometimes quite lamellar and of extreme thinness. These cells have an ovoid or discoid nucleus which is also flattened.

The glomeruli are completely fibrous, and some of them are transformed into small cysts. The glomerular tuft is then more or less atrophied and pushed aside into one corner of the capsule, while the rest of the capsule is filled by a transparent colloid mass.

This particular variety of interstitial nephritis may, like all those which we have already described, be associated with amyloid degeneration.

(*To be continued.*)

A FEW THOUGHTS ON PUERPERAL SEPTICÆMIA, ITS NATURE AND TREATMENT.

BY F. P. ATKINSON, M.D.

Although puerperal septicæmia is no longer the scourge it used to be, I suppose no medical man passes through his professional career without losing at least one case from this disorder; and it is important therefore we should know something definite with regard to its origin and also as to the best method of treatment. As regards its nature there is, and no doubt will be, a good deal of dispute, but I cannot help thinking it will eventually be found to arise either from the infection of erysipelas or the absorption of decomposing animal matter either generated within the uterus from the retention of pieces of placenta, membrane, or clots (the last named especially being the result of imperfect contraction), or conveyed by the nurse or medical attendant from without.

Some assert that it most frequently has its origin in the infection of scarlatina, but there are certainly some very strong facts to be brought forward in opposition to this idea.

1. Cases have over and over again been reported where the parturient woman has been the subject of scarlatina, and the peculiar symptoms of puerperal septicæmia have been entirely absent, and also where there have been cases of scarlatina, not only in the same house, but in the same room and even in the same bed with the parturient woman, without the occurrence of any ill effects.

2. I have been credibly informed by a medical man that he was once called away from a case of scarlatina he was watching to attend two cases of midwifery, and that neither of the lying-in women had any unfavourable symptoms afterwards.

3. I have also been told, and my informant is willing to swear

to the fact, that one medical man attended three cases of confinement when his hands were freely peeling from scarlatina, and that not one of these cases had anything the matter subsequent to their confinement.

In spite of these facts, I believe that serious harm might result were pus from the ulcerating surface of the tonsils to come in contact with an abraded surface of the uterus or vagina.

In the treatment of this as all other kinds of pyrexia it is important to inquire first of all as to the cause of the increased body-heat. In ordinary cold, bronchitis, pneumonia, &c., the prime cause is diminished heat-loss owing to suppression of perspiration, and as soon as the skin begins to resume its function, recovery at once begins to take place, but in septicæmia the cause of the increased body-heat is increased chemical action, owing to the presence in the blood of a greater or less number of disease-germs, and the treatment has to be directed towards checking their growth and life. If this is successful, the cutaneous capillaries begin to dilate and the temperature gradually to fall. In some cases the skin perspires profusely and yet the body-heat remains persistently high, but this results from vaso-motor paralysis and is a symptom of very grave import. The medicines we have at command for checking the life of disease-germs are quinine, resorcin, kairine, salicine, carbolic acid, boracic acid, ether, &c. In the treatment of puerperal septicæmia quinine is particularly useful, inasmuch as it is not only a strong germicide, but also produces a contractile effect on the uterus and prevents fresh absorption. It is a good plan to administer from two to three grains of quinine with five minims of the tincture of digitalis, and from three to five grains of resorcin alternately, every two hours.

If necessary to bring down the temperature rapidly, an ice-bag may be applied to the head and one to the spine, while the body may be sponged with vinegar and water. The uterus should be well syringed out with a solution of permanganate of potash (a drachm of Condy's to the pint of water) three or four times daily, while the temperature remains high.

Plenty of good liquid nourishment should be given, and brandy must be administered according to the severity of the disease.

By the adoption of these means most cases may be led on to a favourable termination.

MICRO-ORGANISMS AND DISEASE.

BY E. KLEIN, M.D., F.R.S.,

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INTRODUCTION.

THE relation of micro-organisms to the infectious diseases is admitted to be very intimate; and although it may not be quite so universal as some are inclined to assume, it is nevertheless definitely proved to exist as regards some of the infectious maladies affecting man and brutes. In order to pass in review all the ascertained facts and observations in this vast and constantly-growing field of pathology, and to appreciate and to assign their true value to the many observations bearing on this relation of micro-organisms to disease, it is necessary that the reader, and still more the worker in this field, should be enabled to criticise the observations and facts brought forward by the numerous writers on the subject, for otherwise he would probably take as proved what has really not passed beyond the stage of possibility. And it is this point which requires the most careful attention, viz., to be able to see at a glance that, owing to the imperfect or faulty method of investigation employed, or that, owing to certain inferences incompatible with the general laws and general tendency of the well-founded and experimentally proved facts, the statements set forth in a particular observation or series of observations are not to be accepted.

In all investigations of the relation of micro-organisms to disease it is necessary to bear in mind that, as Koch[1] has

[1] *Die Milzbrand-impfung.* Cassel and Berlin, 1883.

pointed out, no observation can be said to be complete, or, one should rather say, in no instance can it be said to have been *satisfactorily proved*, that a particular infectious disease is due to a particular micro-organism if any one of the following conditions remains unfulfilled:—(1) It is absolutely necessary that the micro-organism in question is present either in the blood or the diseased tissues of man or of an animal suffering or dead from the disease. In this respect great differences exist, for in some infectious diseases the micro-organisms, although present in the diseased tissues, are not present in the blood; while in others they are present in large numbers in the blood only or in the lymphatics only. These points will be considered hereafter in the special cases. (2) It is necessary to take these micro-organisms from their nidus, from the blood or the tissues as the case may be, to cultivate them artificially in suitable media, *i.e.* outside the animal body, but by such methods as to exclude the accidental introduction into these media of other micro-organisms; to go on cultivating them from one cultivation to another for several successive generations, in order to obtain them free of every kind of matter derived from the animal body from which they have been taken in the first instance. (3) After having thus cultivated the micro-organisms for several successive generations it is necessary to re-introduce them into the body of a healthy animal susceptible to the disease, and in this way to show that this animal becomes affected with the same disease as the one from which the organisms were originally derived. (4) And, finally, it is necessary that in this so affected new animal the same micro-organisms should again be found. A particular micro-organism may probably be the cause of a particular disease, but that really and unmistakeably it is so can only be inferred with certainty when every one of these desiderata has been satisfied.

It will be my aim in the following pages, first to describe the methods that may be employed with success in investigations bearing on the relation of micro-organisms to disease; secondly, to describe in conformity with reliable observations the morphology and physiology of the micro-organisms that bear any relation to disease; and thirdly, to enumerate the observations that have been made in recent years to prove the existence of such

an intimate relation. Last, but not least, we shall consider the precise relation of the particular micro-organisms to the causation of disease.

CHAPTER I.

MICROSCOPIC EXAMINATION.

For the examination of micro-organisms good high powers are essential, at the least a power magnifying 300 to 400 linear diameters. Zeiss' D or E and Zeiss' or Powell and Lealand's oil immersion 1-12th or 1-16th inch will be found sufficient for all purposes. In the case of tissues stained with aniline dyes a good substage-condenser, such as Abbé's or Powell and Lealand's, is invaluable. I use Zeiss' stand with Abbé's condenser, open diaphragm, and plane mirror. As Koch [1] pointed out, and what is now universally acted upon, stained specimens mounted in Canada-balsam solution or Dammar varnish, when examined on an Abbé's condenser, show the micro-organisms with extreme clearness and sharpness.

The examination of the morphological characters of an organism is carried out on fresh unstained as well as on fresh stained microscopic specimens. Although the latter method is, for reasons hereafter to be mentioned, by far the most perfect and reliable one, it is nevertheless important to ascertain as far as possible the appearances, chemical reactions, and general morphology of perfectly fresh specimens. Blood, juices, tissues, and fluids in which the micro-organisms have been growing, are subjected directly without any previous preparation to microscopic examination. With artificial nourishing media in which micro-organisms have been growing, the examination of fresh specimens is of great importance, for the reason that the organisms can be easily identified and their size and general morphological characters be more correctly ascertained than after drying, hardening, and staining. Besides, the chemical

[1] *Die Aetiologie d. Wundinfeetionskrankheiten*, p. 34. Leipzig, 1879. Translated as *Traumatic Infective Diseases* (New Syd. Soc.) London, 1880.

reactions can be satisfactorily studied in fresh specimens only. All one has to do is to draw up with a capillary pipette or to take up with the point of a needle a drop or particle of the material, to place it on an object-glass, and to cover it up with a thin cover-glass. Where one has to deal with liquids, such as artificial nourishing fluids, blood, serum, tissue-juices, secretions, transudations, and exudations, no addition is required. In the case of more solid material, such as solid artificial nourishing material, bits of tissue, &c., the addition of a drop of neutral previously well-boiled saline solution (of 0·6 to 0·75 per cent.) is advantageous, although not absolutely necessary, since by pressing down the cover-glass a layer of the material sufficiently thin for examination can be obtained. In some instances a bit of tissue can be teased out into fine particles by means of two clean needles. Where it is a question of micro-organisms sufficiently conspicuous by their shape, size, and general appearance, their identification in the fresh condition is not difficult; this is the case with bacilli, actinomyces, and mycelia, but in the case of micrococci, especially when isolated or in couples, and lying in blood, juices, or tissues, their recognition is often extremely difficult. When in large clumps, such as larger or smaller masses of zoogloea, or when in the shape of chains, the identification is not difficult; but in the more isolated state they are not easily recognised owing, as a rule, to the presence of granules or particles of various kinds, from which morphologically their distinction is well-nigh impossible. In such cases there are certain rules of thumb, if I may say so, which assist, although they do not absolutely insure, the diagnosis. These are the micro-chemical reactions. The addition of liquor potassæ leaves micro-organisms quite unaltered, whereas fatty and most albuminous granules alter or altogether disappear by it. Acetic acid from 5 to 10 per cent. strong does not affect micro-organisms, but albuminous and other granules become in most instances altered. These two reagents, I think, are as reliable as any others; if they fail, then others like alcohol, chloroform, sulphuric ether, &c., are not of any greater help, but the latter reagents may be used, for instance, when it is a question between fat-granules and micrococci, or crystals and bacilli.

Micro-organisms have a great affinity for certain dyes, especially aniline dyes, and therefore these are used with great success to demonstrate their presence, and to differentiate in many instances morphological details which in the unstained condition are not discernible. The staining is effected on fresh unaltered organisms, or after they have become dried. In the first instance the process is carried out thus:—A microscopic specimen is made, and to it is added afterwards drop after drop of the dye, passing it through the specimen in the usual way of applying fluids to a microscopic specimen, *i.e.* by adding with a capillary pipette the dye at one margin of the cover-glass and sucking it up with a strip of filter-paper applied to the opposite margin of the cover-glass. When the staining has taken place the excess of the dye is washed away with salt solution, water, or alcohol, or both, as the case may be (see below). Unless the organisms are embedded in continuous masses of solids, this method gives good results. In the latter case, say if they are embedded in a microscopic lump of tissue, or in a particular spot of a fine section of a fresh tissue, it is necessary, after having placed the lump or section on an object-glass, to drop the dye on to this previous to putting on the cover glass. After some minutes the dye is allowed to run off by inclining the object-glass, and then the washing is proceeded with till all the excess of the dye is removed; the mounting is then done by placing a drop of water or salt solution on the specimen and covering it with a cover-glass. In the case of sections through fresh and hardened tissues containing micro-organisms, the method of staining and of permanently mounting them as a whole is more complicated, and will be detailed presently. When one has to deal with coherent masses of micro-organisms, present either in natural media (*i.e.* animal tissue), or artificial cultivations, such as zoogloea and pellicles of *micrococcus* or *bacterium*, these can be bodily transferred to a watch-glass, stained, washed, and mounted without much difficulty, either for immediate or permanent use. The permanent specimens are made in this way:—Place the sections or pellicle in a watch-glass containing the dye, leave it there till deeply tinted, take out with a needle or the like, wash in water, then in alcohol, leave here for five minutes or more till most of the excess of the colouring-

matter is removed, then lift it on to an object-glass, spread well out, place on it a drop of clove-oil, and after a minute or two drain off the clove-oil, add a drop of Canada-balsam solution (in chloroform or benzol), and cover with a cover-glass. In some special instances, such as the bacilli of leprosy and tuberculosis, double staining is required. With other organisms, such as the bacilli of glanders or tuberculosis, the washing is carried out, not with water, but with acid (acetic acid and nitric acid respectively). All these details will be stated when dealing with these special organisms.

The method extensively and successively used for the demonstration and preservation of microscopic specimens of micro-organisms in fluids, as blood, pus, and juices, is that of Weigert and Koch, which consists in spreading out on a glass slide or cover-glass a very thin film—the thinner the better—of the fluid (artificial or natural culture medium), blood, pus, or juice, and drying it rapidly by passing it several times over the flame of a spirit-lamp or gas-burner. The most successful preparations are obtained when the heating is carried on for such a time (one or two minutes) that the film, having become opaque at first, rapidly turns transparent. Several drops of the aniline dye to be used are then poured over the specimen, and after remaining on it from five to thirty minutes or more are poured off. The aniline dyes used are those that are commonly known as having a great affinity for cell-nuclei (Hermann) ; they are also known as the neutral or basic, but not the acid ones. The most useful aniline dyes amongst them are those that are soluble in water; these are preferable to those soluble in alcohol, but in certain special instances (to be mentioned hereafter) some of them are of definite use. Methyl-blue, methyl-violet, vesuvin, Bismarck-brown, magenta, fuchsin, rosanilin, gentian-violet, Spiller's purple, eosin, dahlia, purpurin, iodine-green, are the aniline dyes commonly used. The washing is carried out in all cases, except with tubercle-bacilli and the bacilli of glanders, with distilled water, then with alcohol; this latter as a rule is to wash out the dye from all parts except the micro-organisms, and it is therefore necessary not to carry the washing further than this, but to carry it as far as practicable. After this, wash again with distilled water, dry, and mount in a drop of Canada-balsam

solution. Throughout this process it is of course necessary always to remember on which side of the glass the specimen has been dried.

Double staining is carried out with any two of the above dyes; as a rule a brown and blue or violet, or a red and blue, are preferred. Some of the violet and purple dyes have the peculiarity that in some—not in all instances—they give to the preparation a double tint—some things appear blue, others more pink.

The process of double staining is carried out either for each dye separately—*i.e.* we first apply one dye, after some minutes wash in distilled water, and then apply the second dye—or the two dyes to be used are mixed and then used like a single dye.

In the case of tubercle-bacilli the staining is first done with a magenta mixture (Ehrlich's, Weigert's, or Gibbes', see below), then washed for a few seconds with a 10 per cent. solution of nitric acid, then for a few minutes with distilled water. After this the preparation is stained with methyl-blue in the ordinary way. Or, after Koch's method, the specimen is first stained in alkaline methyl-blue (mixed with a 10 per cent. solution of caustic potash) for twenty-four hours, dried for half an hour to one hour at a temperature of 40° C., and then stained in a concentrated solution of vesuvin. Wash it next with water, then with alcohol, dry, and mount in Canada-balsam solution.

In leprosy, the specimen on the glass is stained with magenta, then washed in distilled water, then stained with methyl-blue, washed, and mounted. With such organisms—as *e.g.* the micrococcus in the sputum of acute croupous pneumonia, and the micrococcus in gonorrhœal discharge—the staining is best carried out with a mixture of methyl-blue and vesuvin.

Weigert's double stain is very excellent for many purposes; it is prepared thus:—

Saturated watery solution of aniline, 100 ccm.

[This is made thus:—Aniline oil, 1 part, dist. water, 3 parts. Shake every half hour for four hours, and decant the water as the oil settles to the bottom.]

Saturated alcoholic solution of fuchsin, 11 ccm. Mix.

The sections are well stained in this mixture, then washed in distilled water; after this they are immersed for a few seconds in alcohol, and then transferred for one, two, or three hours to the following solution:—

> Distilled water, 100 ccm.
> Saturated alcoholic solution of methyl-blue, 20 ccm.
> Formic acid, 10 minims.

After this, wash in alcohol, pass through clove oil, and mount in Canada-balsam solution.

In examining fresh or hardened tissues for micro-organisms it is necessary to make thin sections, which can be easily done with the aid of any of the microtomes in common use, amongst which Williams' microtome, and especially Dr. Roy's ether-spray freezing microtome, are no doubt the best and easiest to manipulate. As regards hardened material, it is necessary to remember that the hardening must be carried out properly, small bits—about a half to one cubic inch—of tissue being placed in alcohol, or better in Müller's fluid, and kept there; in the first instance, for two to five days; in the second, for from one to three weeks or more. Then small bits are cut out, of which it is desired to make sections. Those hardened in spirit must be soaked well in water to enable the material to freeze, then superficially dried with blotting-paper, and then used for cutting sections with Roy's microtome. Those hardened in Müller's fluid are at once superficially dried with blotting-paper and cut. When making sections with Williams' freezing microtome it is necessary to soak the material first in gum mucilage and then to freeze and to cut. Fresh tissues are at once cut with the freezing microtome, the sections placed in 0·6 per cent. of saline solution, floated out and well spread out, and then stained by transferring them in this condition, *i.e.* well spread out, into a watch-glass containing the dye. The sections of hardened tissues are floated out in water, well spread out, and then transferred to the dye or dyes as the case may be.

It is necessary to prevent too much shrinking of the sections, especially those of fresh tissues; for this reason it is advisable to float the sections in the saline solution or water, as the case may be, on a broad lifter or spatula, to spread them well out

upon it, and to transfer them carefully into the dye, then into the dish with water used for washing off the excess of the dye, to transfer them, well spread out on the lifter, to alcohol, then after several minutes to oil of cloves, and finally on to a glass slide, on which they are mounted in the usual manner with Canada-balsam solution, the excess of clove-oil being previously drained off.

CHAPTER II.

PREPARATION OF CULTURE MATERIAL.

Artificial cultivations of micro-organisms in suitable nourishing media in the incubator (Fig. 1) at temperatures varying between 30° and 40° C., are necessary in order to study more accurately the life-history of the septic as well as the pathogenic organisms. Moreover, large numbers of them become thereby available, and their exact relation to disease can thus be tested more conveniently. For if it should be found that, having carried on outside the animal body successive cultivations of a particular organism, the reintroduction of this cultivated organism into the animal body is again productive of the same disorder as before, then the conclusion becomes inevitable that this organism is intimately related to the causation of the disease. It must be conceded that after several successive cultivations any hypothetical substance supposed to be the *materies morbi*, and introduced at the first remove from the blood or tissues, being in a very diluted condition in the first cultivation, would after several cultivations be practically lost. But if this last cultivation should be found to act in the same manner pathogenically, *i.e.* if every droplet of it, charged with the new brood of the organism, nevertheless possesses full pathogenic power, then it is logical to say that this pathogenic property rests with the organism. For this and other reasons it is of essential importance to be able to carry on successive cultivations of one and the same organism without any accidental contamination or admixture, *i.e.* it is necessary to carry on *pure cultivations.*

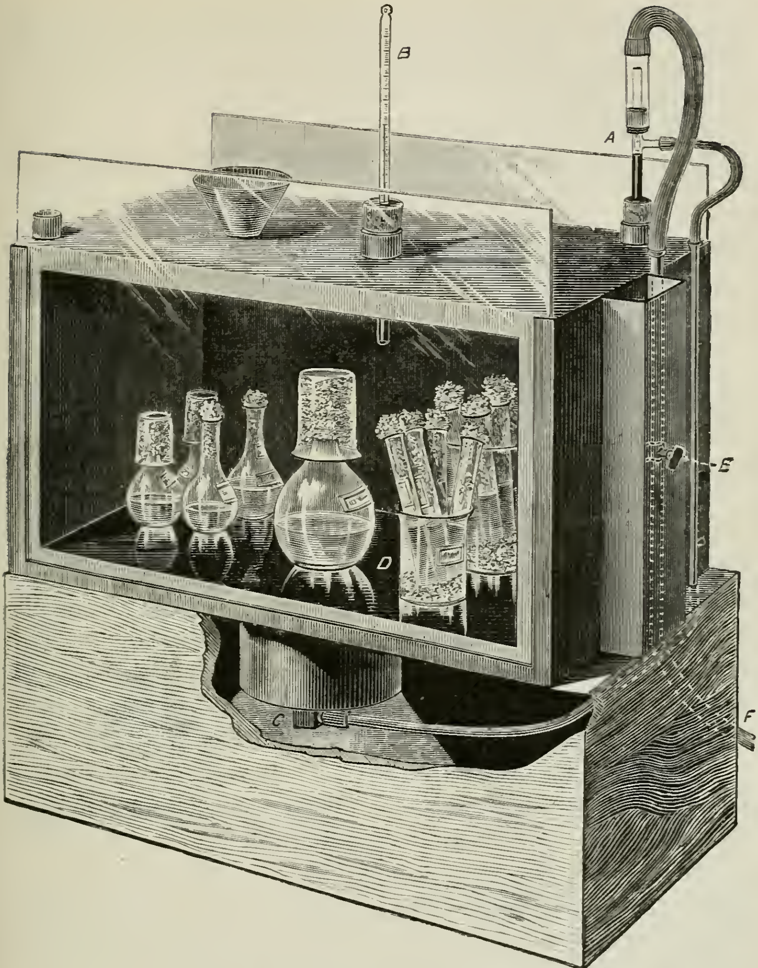

FIG. 1.—INCUBATOR, WITH PAGE'S REGULATOR.

A. Page's regulator.—This consists of a tube filled with mercury, and immersed in the water surrounding the chamber of the incubator. In the upper part of the tube, above the mercurial column, is a fine open glass tube, having near the lower end a fine hole. When the temperature of the water rises, the mercurial column rises, and at a certain temperature rises above the lower open end of the small inner glass tube just mentioned. If this point is reached, then the burner at C receives only the amount of gas that passes through the fine lateral hole of that inner glass tube. If the temperature of the water falls, the mercury falls, and the lower end of the inner glass tube becomes again free, and now the burner at C receives a much greater supply of gas. If so, the temperature of the water again rises, the mercury rises, obstructs the lower end of the inner glass tube, the supply of gas is reduced to what can pass through the fine lateral hole, and consequently the temperature again falls, and so on. To adjust the regulator it is necessary when the thermometer indicates the required degree of temperature to push the outer large glass tube—and with it the inner tube—of the regulator so far down that the top of the mercurial column just obstructs the free end of the inner glass. The temperature then regulates itself for the reasons stated previously. These regulators are sufficient for all practical purposes when it is not a question of small differences in temperature, since they are tolerably constant within one or two centigrades. The trouble one experiences in the working

of these and other similar regulators arises from the inconstancy of the main gas supply, this, as is well known, varying within wide limits. The stopcock, E, obviates this to a limited extent: when this is put at an angle of 45° only a limited amount of gas passes from the main supply tube to the regulator, and therefore the variations in pressure of the gas are not felt to their full extent. A Sugg's regulator interposed between E and the main supply tap is very useful.

B. Thermometer to indicate the temperature in the chamber.

C. Gas burner.

D. Chamber of incubator.

E. Stopcock to regulate when required the supply of gas.

F. Main supply. The upper, lower, right and left walls of the incubator are made of a double layer of tin; between the two is water. The front and back of the chamber are closed by a movable glass plate.

ARTIFICIAL CULTIVATION MEDIA.

A.—Fluids.

As fluid nourishing material the following are used with preference :—

1. *Broth made from meat—pork, beef, rabbit, chicken.*—The connective tissue and fat are first cut out from the fresh meat —in the case of rabbit or chicken the whole animal without head or viscera is used—and then placed in water and boiled. Generally for each pound half an hour's good boiling is allowed. With regard to the quantity of water, each pound of meat ought to yield ultimately at least one pint of broth. When boiled, the broth is allowed to stand, the fat is skimmed off, and the broth well neutralised by adding liquor potassæ or, better still, carbonate of sodium.

The fresher the meat the less acid (sarcolactic acid) is in the broth before neutralisation. The broth is then filtered through a filter, previously overheated (see below), into flasks previously sterilised (see below). If the broth is not clear after once filtering it is filtered again. If not clear then, it is allowed to stand for several hours. A fine sediment is found at the bottom of the vessel, and from this the clear supernatant fluid is decanted into a sterilised vessel. The broth, if not clear after the first filtering, can be cleared by boiling it with the white of an egg. The now clear fluid is filtered again. The flasks which receive the broth are well plugged with sterilised cotton-wool (see below). In this state the flask is placed over a Bunsen burner (Fig. 2) on a wire netting and boiled for half an hour or more ; during the boiling the cotton-wool plug is lifted out for half its length. The flask ought not to contain more broth than about one-half or two-thirds of its volume, to prevent

the broth from rising too much and wetting the plug. When turning off the flame the plug is pushed down so as fully to plug the neck and mouth of the flask; a beaker with sterile cotton-wool cap is placed over the mouth of the flask (Fig. 3), and this is allowed to stand for one night. Next day the boiling is repeated for half an hour or more in the same manner as before. If the meat has been fresh and the vessels and cotton-wool have been sterile, twice boiling is found sufficient to destroy every impurity. But to make sure, the broth is placed in the incubator and kept there for twenty-four hours at a temperature

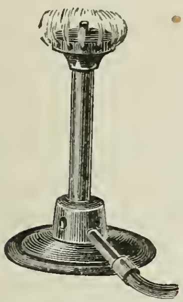

Fig. 2.—A Bunsen Burner, with Rose for Boiling Fluids in Test Tubes.

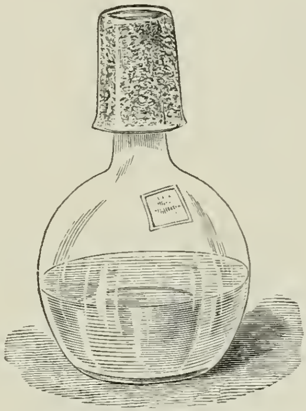

Fig. 3.—A Flask containing Sterile Stock Fluid.

of 32°—38° C., and then boiled on the next day for half an hour in the usual way. The supposition is made that if by any chance after twice boiling the broth it should contain unchanged spores of bacilli—the only organisms that will resist boiling, although they do not resist boiling for more than half an hour—the spores would germinate into bacilli when kept for twenty-four hours in the incubator at 32°—38°, and these would then be killed by the third boiling. As a matter of fact I have not as a rule found any contaminating germs survive the second boiling. It is of course to be borne in mind that during the first as well as second and subsequent boiling the cotton-wool plug is not removed from the mouth of the flask, but is only raised out half its length from the neck. The cotton-wool and the cotton-wool

cap and beaker are replaced immediately or simultaneously with the turning off of the burner. This broth so prepared is placed in the incubator at 32°—38° C. and kept there from one to three weeks. If, as is generally the case, it remains limpid, it is considered completely sterile.

2. *Peptone and Sugar Solution.*—Beef peptone (Savory and Moore's) is dissolved in distilled water, over a burner, to the amount of about 2 per cent.; to the solution is added cane sugar to the amount of about 1 per cent., so that every 100 ccm. of the fluid contains two grammes of peptone and one gramme of sugar. When dissolved it is well neutralised and then filtered (the vessels being of course also in this, as in all other cases, sterilised by overheating) into flasks, and treated in the same manner as the broth.

The same fluid can be used without the addition of the cane-sugar.

3. *Buchner's Fluid.*—10 parts of Liebig's extract, and 8 parts of peptone, in 1,000 parts of water.

4. *Hydrocele Fluid* (Koch).—A new or well sterilised (by overheating) trocar and cannula are used for the tapping; to the cannula is fixed an indiarubber tube that has been soaking in strong carbolic acid solution for forty-eight hours. The distal end of the tube is introduced carefully and rapidly into the neck of a sterilised flask plugged with sterile cotton-wool, and the fluid thus allowed to flow into the flask to about two-thirds of its volume. This is then exposed in a water- or sand-bath to a temperature of from 58° to 62° C. for three to five hours on five or six consecutive days. Placed then into the incubator at 32°—38° C. for from one to three weeks, the fluid remains limpid.

5. *Blood Serum* (Koch).—A glass cannula and indiarubber tubing are soaked for forty-eight hours in strong carbolic acid; the cannula is tied into the carotid artery of a healthy sheep, and the arterial blood, after opening the clip at the proximal end of the artery, is allowed to flow into a sterile flask, the distal end having been introduced into the neck of the flask as above. After letting it stand for twelve to twenty-four hours the clear serum is taken off by means of a large sterilised glass pipette or glass syphon; this is carefully introduced between

the cotton-wool plug and glass neck, and then discharged into a sterile plugged flask or large test-tube, the pipette or syphon being also here carefully introduced between cotton-wool plug and glass.

This stock serum is then heated for successive days in the same manner as the hydrocele fluid.

Of less common use are :

6. *Pasteur's Fluid.*—In 100 parts of distilled water are dissolved 10 parts of pure cane-sugar, 1 part of ammonium tartrate, and the ash of 1 part of yeast.

7. *Cohn's Fluid.*—100 ccm. of distilled water, 1 gramme of ammonium tartrate, no sugar, and instead of the ash of yeast are substituted (A. Mayer) 0·5 gramme of potassium phosphate, 0·5 gramme of crystallised magnesium sulphate, 0·05 gramme of (tribasic) calcium phosphate. These two fluids are treated in the same manner as the broth and peptone solutions.

B.—Solids.

The solid media have the great advantage over the fluids that in the former artificial cultures can be carried out more easily; as, owing to the resistance the solid basis offers to the growth of the organisms, they remain more limited to the spot or spots on which they are sown, and therefore can be watched more easily; besides, an accidental contamination, *i.e.* a growth appearing at a spot at which no sowing was made, can be recognised at once. These advantages are perhaps of the greatest use when it is intended to grow the organisms on a surface exposed to the influence of air—of course protected from contamination with other organisms.

These advantages of solid media have been very minutely pointed out by Koch in his researches on pathogenic bacteria.[1]

As solid media are used :

1. *Slices of Boiled Potato or Boiled White of Egg or Paste* (Fokker, Schröter, Cohn, Wernich).—Although these are of great use in the study of hyphomycetes, and especially of pigment-bacteria, they are not generally used in the case of other bacteria and pathogenic organisms. The progress of the growth

[1] *Mittheilungen d. k. Gesundheitsamtes*, i. 1880.

of a particular organism sown out at a particular spot or line on the surface of these substances can be easily watched with the unaided eye. These substances when quite fresh are placed on flat glass dishes; these are covered with a well-fitting bell-glass, the space being kept moist by a piece of moist blotting-paper placed in the dish.

2. *Gelatine* (Brefeld, Grawitz, Koch).—This is used advantageously as a mixture with broth, peptone, beef-extract, blood-serum, or hydrocele fluid. Koch, who introduced this mixture, used it for the cultivation of bacteria on solids, to be exposed to the air; the proportion of gelatine in the mixture was 2 to 3 per cent. But this mixture, although solid at ordinary temperature, does not keep solid in the incubator, not even at 20° C. I have found that at least 7·5 per cent. of gelatine must be contained in the mixture to keep it solid at 20° to 25° C. Above this temperature not even 11 per cent. gelatine will keep solid.

The finest (gold label) gelatine, in thin tablets, is cut up in small strips; these are soaked in distilled water (1 in 6) overnight, and then dissolved over a water-bath, well neutralised with carbonate of sodium, and filtered hot. If not clear, it is boiled with white of egg, and passed hot through sterilised fine calico. Then this fluid is mixed with half its bulk of broth, peptone solution, or beef-extract solution, so that there is 1 part of gelatine in 9 parts of fluid, or $11\frac{1}{9}$ per cent. of gelatine. This mixture is boiled repeatedly and treated like broth, as described above. The mixture can, when cast solid, be liquefied by melting it on the water-bath, can be easily decanted into sterilised plugged test-tubes (see below), and can then be used as a good solid nourishing material for the cultivation of organisms up to 25° C.

The above gelatine solution without admixture can be boiled once or twice, and thus made sterile and kept as a stock. This can be used as an addition to blood-serum or hydrocele fluid; the mixture must be sterilised in the same way as serum or hydrocele fluid alone, *i.e.* exposed for five to seven days to a temperature of 58° to 62° C. Of course, whatever the proportions are in which the two are mixed, the mixture does not keep solid above 25° C. But by exposing it for from several days to several weeks to the heat of the incubator, the mixture

can by evaporation be rendered practically solid for higher temperatures also.

3. More satisfactory, because capable of remaining solid at any temperature, is solid serum of blood, solid hydrocele fluid, and Agar-Agar (Koch).

The first, *i.e.* the serum of blood, and the second, *i.e.* the hydrocele fluid, can be made solid by heating the above sterile serum or hydrocele fluid respectively (see page 182) *gradually* up to 68°—70° C. In the course of an hour or two the material becomes solid, losing very slightly its limpidity, but is sufficiently transparent for all practical purposes. By heating it rapidly, or heating it above 70°, it becomes solid, granular, and opaque. Of course, once thus made solid it cannot be liquefied again, and therefore must be already contained in the vessels (test-tubes and small flasks) in which the growth of organisms is to be carried on. Or blood serum and hydrocele fluid can be rendered solid by exposing the sterilised material (see above), in sterile plugged test-tubes, to a moderate heat—*e.g.* in the incubator at 32° to 38° C.—for several weeks. Through evaporation the material is rendered solid. Thus treated it retains its limpidity in a perfect manner.

Agar-Agar, or Japan isinglass, is very difficult to obtain,[1] it is sold in the shape of very thin, shrivelled, transparent lamellæ, or narrow bands. It is soaked overnight in distilled water (one to five or six), and then dissolved on the water-bath; well neutralised with carbonate of sodium, and filtered and mixed with a third of its bulk of broth, peptone, or beef-extract solution. I use as a rule peptone and sugar solution, as described above. Well boiled on two or three successive days, each time for thirty minutes to an hour, in sterile flasks, a sterile material is obtained, which is quite transparent, and remains solid up to a temperature of 45°—50° C., *i.e.* a temperature much higher than is ever used for the cultivation of micro-organisms. It becomes liquid at higher temperatures, and in case of necessity can be again subjected to boiling. Before considering it as perfectly sterile it ought to be kept like all other materials for from several days to several weeks

[1] Messrs. Christy and Co., of 155 Fenchurch Street, have succeeded in obtaining for me large quantities of this material from Paris.

in the incubator at 32°—38° C. If quite limpid after this time it may safely be considered as sterile.

Amongst all the solid media, I have found this mixture of Agar-Agar and peptone sugar solution to be the best in many respects. It is beautifully limpid and solid, and an excellent nourishing material. Agar-Agar alone, as recommended by Koch, without admixture of peptone and sugar is not so satisfactory as a culture medium.

(*To be continued.*)

ON THE ACTION OF THE SALTS OF LIME, STRONTIAN AND BARYTA, ON THE HEART.

BY JAMES BLAKE, M.D., F.R.C.S.

In the *Practitioner* for August 1883, Dr. Ringer publishes some investigations, the object of which he states to be—" to ascertain how far the chemical similarity between lime, strontium, and barium indicates similarity in their physiological and, therefore, in their therapeutic action." The facts contained in Dr. Ringer's paper are undoubtedly interesting, but so far as the main object of his investigation is concerned, I had solved the question many years ago, as he will find by referring to the *Proceedings of the Royal Society* for 1841. After detailing experiments made by injecting various saline solutions into the blood of living animals, including the salts of lime, strontian, and baryta, I observe, " The most curious fact which a consideration of the above experiments presents, is the close connexion which appears to exist between the physiological action of these substances and their chemical properties. The property to which I more particularly allude is that of isomorphism. The analogy in the physiological action of isomorphous compounds was first forced on my notice by the perfect resemblance that exists between the salts of silver and the salts of soda in their physiological action when injected into the veins, differing as these salts do in their sensible chemical properties but closely connected as being isomorphous. Farther investigation soon proved to me that this fact was of far more importance than I had anticipated, by showing that most striking points of

resemblance exist generally between isomorphous substances in their action on the animal tissues when introduced directly into the blood."[1] Within the last few months these results of my experiments have been again published in a paper on another subject read before the Académie des Sciences at Paris. In this paper, the salts of lime, strontian, and baryta were classed together as producing analogous physiological effects. As the abstract of the paper, which appeared in the *Comptes Rendus*, was translated in the *Journal of the Chemical Society* and in the *Chemisches Centralblatt*, it is curious that the subject should have escaped Dr. Ringer's notice. I would also call attention to a fact which I published in 1839, but which has recently been rediscovered as a corollary to Dr. Ringer's experiments on "The Influence of the Different Constituents of the Blood in the Contraction of the Heart," published in recent Nos. of the *Journal of Physiology*. By these experiments it has been shown that the different salts of the same base exert the same effect on the heart. In a paper on the action of different saline solutions when introduced directly into the blood of living animals, read before the Académie des Sciences in 1839, I stated, when alluding to the relation between chemical constitution and physiological action, "Le rapport n'est pas il est vrai tel que l'état actuel de la science des affinités chimiques nous l'eut fait prevoir, car il est évident que les décompositions effectuées dans le sang par ces sels, décompositions sur lesquelles roule toute leur action physiologique, dépendent de la base du sel, et ne sont que peu modifiées par la combinaison de cette base avec les acides, même les plus puissants." It will thus be seen that this preponderating influence of the base in determining the physiological action of a salt is a fact which I published nearly half a century ago. I am happy that I cannot share with Dr. Ringer the hope that these experiments are likely to throw much light on therapeutics, at least for many years; nor do I think it desirable that they should be pursued in connexion with that subject; for I believe the great curse of physiological investigation, particularly in England, is its too intimate connexion with therapeutics. That physiology must constitute the only solid

[1] The Memoir was first published in full in the *Edin. Med. and Surg. Journ.* No. 148.

foundation for therapeutics there can be no doubt, but physiology has not yet assumed a sufficiently scientific form to permit the practical application of its results to serve as an indication for the lines which physiological investigations should follow. Had the chemists in the earlier part of the century been afflicted with the patent-chemistry epidemic that at present is raging so severely, particularly in Germany, the science would have been far less advanced than it now is.

A SHORT ANALYSIS OF FIFTY CASES OF RHEUMATISM TREATED BY THE BATH THERMAL WATERS.

BY W. M. BEAUMONT, M.R.C.S., OXFORD.

Now that a course of the Bath waters is becoming more and more the recognised treatment of chronic rheumatism, it may be of some interest to inquire into the results of such treatment. I have, therefore, collected a series of fifty sequent cases which were admitted into the Mineral Water Hospital, Bath, during the three months that I was acting as Resident Medical Officer there, from the beginning of October 1883 to January 1884. There were in all fifty-six cases admitted, treated, and discharged within that period; the last six have been omitted in order to reduce the cases to fifty, a more manageable number for statistical purposes.

In the first place it is necessary to state, that by "rheumatism" I include all the diseases usually classed under that term, with the exception of acute rheumatism and rheumatoid arthritis. Acute rheumatism, so far as I know, has never been treated by a systematic course of thermal bathing. Rheumatoid arthritis I omit, as it appears to me that the balance of evidence is opposed to a rheumatic origin—the rarity of a prior attack of acute rheumatism; the usual absence of cardiac complications; its preference for the female sex, whether young or old[1] (a typical, fully developed case of rheumatoid arthritis in a young male is indeed a rarity); the sub-normal temperature of the body, for a patient suffering from this disease usually has a temperature below 98° F.—these and many other facts seem to be sufficient to separate it entirely from rheumatism, in spite of

[1] "Clinical Lectures on Senile and Chronic Diseases," by J. M. Charcot, *Syd. Soc. Trans.* p. 203.

such high authorities as Todd, Adams, Charcot,[1] Mitchell Bruce,[2] and others.

I find that out of the fifty cases there were thirty-nine males and eleven females, the average age of the former being forty-one years and that of the latter thirty-eight years. The previous duration of the disease averaged seventeen months per case. Twenty of the fifty patients had at some period of their lives suffered from acute rheumatism, and of these twenty, twelve had some form of heart-disease (valvular, hypertrophy, pericardial, &c). Of the thirty patients who had never suffered from acute rheumatism only four had cardiac complications. The average stay in hospital was forty days per patient.

The thermal treatment consisted of one bath on alternate days (omitting Sundays), the immersion lasting twenty minutes for each bath. The first few baths were taken at a temperature of 98° F.; if these were well borne, during the rest of the treatment the bath was taken at a temperature of 105°, unless there was advanced aortic disease: mitral disease rarely debarred from the use of the hot bath. In addition to the bathing a glass of the thermal water was drunk every morning. In a large proportion of cases additional treatment was resorted to, consisting of medicines, liniments, vesication, and pulleys; with fourteen patients no such additional means were used, and in judging of the share taken by the drugs in the treatment it must not be overlooked that in all the cases therapeutic means had been resorted to with scarcely any benefit, usually for long periods, prior to admission into the Mineral Water Hospital. The douche was used in many of the cases.

Next as to results. For this purpose the cases are divided into four classes, viz.:—I. cured, II. much better, III. better, IV. no better.

I. With regard to the "cured": naturally very few come under this head; in fact only such as, on being discharged, had neither an ache nor a pain are included: they number six. These cases are worthy of a little detailed examination. *Case* 1, a woman aged 48 was admitted into the Mineral Water Hospital

[1] "Clinical Lectures on Senile and Chronic Diseases," by J. M. Charcot, *Syd. Soc. Trans.*

[2] Quain's *Dictionary of Medicine*, Art. "Rheumatic Arthritis."

suffering from chronic rheumatism, to which she stated she had been subject for three years. After twenty-one days thermal treatment all symptoms had entirely subsided, and she was discharged "cured": the only auxiliary means used was a stimulating liniment. *Case* 2, a man aged 21, with mitral regurgitation, who had suffered from acute rheumatism on two occasions, was admitted suffering from rheumatic pains in the joints, of three years duration, and was discharged "cured" after forty-eight days treatment, with the addition of quinine and a liniment. *Case* 35, a woman *æt.* 19, who had been laid up in 1871 with acute rheumatism following scarlatina. Chronic rheumatism for six weeks prior to admission; "cured" after taking the baths for nineteen days and without the aid of medicine. *Case* 42, a man *æt.* 60, had suffered from rheumatism for the last five years continuously, the stress falling chiefly on the left thigh, which, on admission, he could not flex at all, nor could he remember when he had last been able to do so. After twenty-two days treatment he was discharged cured, being then able to move the thigh freely in all directions. No medicines or liniments were used in this case. *Case* 44, a male aged 19, suffering from the sequelæ of acute rheumatism (complicated with mitral disease) of two months standing, was discharged cured after forty-four days; vesication and iodine having been additionally used. *Case* 47, a male *æt.* 56, who had been unable to get his arms above his head or his hands to his mouth for six weeks, in consequence of rheumatism, was cured after undergoing treatment for twenty-nine days. No medicines were used.

II. The great majority of cases are included under the head of "much better," namely thirty-five, all of whom on being discharged were in a very different condition from the plight they were in on admission into hospital. *Case* 5, a man of 58 suffering from chronic rheumatism in the shoulders, arms, and hands, following an acute attack, after forty-two days treatment was able to button his clothes—the first time for six months, no medicine having been administered whilst in the hospital. *Case* 14, a woman aged 32 after fourteen days in the hospital could run down stairs, not having been able to do such a thing previously for three years—the only additional treatment

was iron and digitalis for palpitation of the heart. *Case* 19, a male aged 56, was discharged "much better" on the sixty-sixth hay. On the nineteenth day he could walk much better than de had done for three years, one blister being the only additional remedy resorted to. *Case* 37, a very striking one, full notes of which are appended below. *Case* 49, a man aged 52 suffering from the sequelæ of an attack of acute rheumatism three months previously, could not get his hands to his head nor dress himself when admitted, but was able to do both when discharged on the fifty-seventh day. In this case cod-liver oil and iron were administered, but not till after the improvement in the joints had taken place.

III. Six patients were described as "better" when discharged; two of these cases had additional diseases which complicated the treatment. *Case* 28, a girl of 20, had amenorrhœa as well as rheumatism. *Case* 40, a man of 48 suffering from articular rheumatism and leucocythæmia, the latter disease apparently dating from a second attack of acute rheumatism nineteen months previous to admission. He was retained in hospital twenty-six days, and was then discharged "better" so far as the rheumatism was concerned, the pain and swelling of the large joints having subsided, although the splenic enlargement remained *in statu quo*.

IV. In the last class come the failures, three patients being discharged "no better." *Case* 31, a woman *æt.* 25, suffering from the sequelæ of acute rheumatism three months previously, was discharged no better after forty-one days treatment—drugs, liniments, and iodine having been additionally used. *Case* 32, a man of 53 with mitral disease, left, contrary to advice, on the thirty-sixth day. He had previously been a patient in 1873 for fourteen days, suffering from rheumatism, and cured, remaining well for two years. *Case* 45, a man aged 43 remained in forty-nine days, and was then discharged "no better"; the case being complicated by the mental strain attendant on bankruptcy.

With regard to the question of how long the benefit lasts after leaving the hospital something may be learnt from the re-admissions. I find that out of the fifty cases there are six patients who have been treated at the Mineral Water Hospital before; the average period that the benefit lasted in these six

was two years and three months. *Case* 16, was in for two months in 1882, and left "much better," remaining so for eleven months. *Case* 18, a patient for three months in 1879, and discharged "much better," remained well for three years. *Case* 19 underwent treatment for six weeks last year, and left improved. On the second visit (this year) he responded much more favourably to the treatment, and there is every reason to expect that the benefit will be more permanent, as on being discharged after the second course of baths he was much better than he had been for three years. *Case* 20, not a very satisfactory one, had been a patient twice for gout, and three times for rheumatism, leaving improved each time. *Case* 30 was admitted for sciatica in 1878 and discharged cured, not having had a return of it. *Case* 32 was admitted in 1873, and left cured after fourteen days, remaining well for two years.

In conclusion I append notes of *Case* 37, a striking though not a phenomenal result.

W. J., a clerk, *æt.* 51, admitted into the Mineral Water Hospital, Bath, on November 10, 1883, under the care of Dr. J. K. Spender. He stated that he had suffered from "brain fever" when five years of age, otherwise had good health until February, 1881, when he was exposed in the snow. A week later he developed acute rheumatism, and was taken to Guy's Hospital. I am indebted to Dr. Goodhart, under whose care he was, for notes of this illness. The chief points of interest were the excessive delirium, lasting many days, and his late age for a first attack. The temperature was 104° on admission, remaining up for eight days. He was treated with salicylate of sodium in half drachm doses, and for a short time brandy was administered. An attack of pericarditis prolonged the convalescence, and he was made an out-patient on April 10th. Stiffness of the joints of the upper extremities supervened soon after leaving Guy's, and he continued attending the out-patient department for six months. He states that he took guaiacum and other medicines, including cod-liver oil; also he used liniments, but without much advantage. Turkish baths were tried without avail. Then he went to Southend, and took hot sea-baths on alternate days for two months, without deriving any benefit. He got thoroughly disheartened, and gave up all treatment,

except that occasionally he had his arms rubbed with turpentine. He was advised to try the Bath thermal waters as a *dernier ressort*, and was admitted into the Mineral Water Hospital on November 10, 1883. On admission, his shoulders, elbows, and wrists were stiff and almost immoveable ; there was some thickening round the joints. He could not get his hands to his head, and he stated that he had been unable to dress himself since his illness nearly three years ago. He could only use a pen for a few minutes at a time, and was quite unable to feed himself. His improvement began with the first bath ; and on December 8th he was able to wash and dress himself for the first time. On December 19th he could write and do wool-work ; he could get his arms above his head and brush his hair. He was then discharged "much better," no medicines or liniments having been used.

Finally, whether drugs have or have not any share in his cure matters very little to the patient ; the fact remains for him that from medicine alone he has derived no good, with thermal treatment added he has been cured or very much benefited. The cases I have related are in no ways picked ones, but it must not be overlooked that the patients come from all parts of the three kingdoms. It follows from this that they are commonly *picked bad cases*—men and women who have tried all lines of treatment without avail. Many of them were sent in from workhouses and unions, where they had been regarded as "incurables." Remembering this, it appears to me that the results are very favourable ; and if forty-seven out of fifty patients, suffering from a disease which is usually considered such an *opprobrium medicinæ* as chronic rheumatism, were cured or relieved by an average treatment of forty days' duration, then the answer to the question of our rheumatic patient "Shall I try Bath ?" ought not to be very difficult.

THE USES OF PEROXIDE OF HYDROGEN.

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Peroxide of Hydrogen (H_2O_2) is one of those remedies which, having as it were lain dormant for long after its introduction to the notice of the profession, seems now to have been awakened into active therapeutic life mainly on account of its antiseptic properties. It has been known and used as a bleaching-agent for the hair, changing dark hair to lighter shades, in virtue of its destructive action upon organic colouring matter. Recent investigations, as those carried out by M. Miguel of the Observatoire de Montsouris, appear to establish its claim as one of the most potent destroyers of bacterial life. By American dentists it is largely used as the basis of a mouth-wash, and its use has lately been re-advocated in that country (see the *New York Med. Rec.*, Jan. 19) for the treatment of venereal diseases, and as a delicate test for pus. Its action upon pus is rather remarkable. If a few drops of the ordinary 10 per cent. solution be brought into contact with pus, a brisk effervescence at once commences, and continues until all the pus is completely destroyed. This action is well shown by applying a little of the solution to the surface of a sloughing ulcer; not only is the pus destroyed, but the surface of the wound is directly stimulated, and healthy repair is permitted by the marked antiseptic properties of the fluid. These favourable effects are especially noticeable in syphilitic ulcers of all kinds; and the remedy possesses the great advantage of being painless in its application. The effervescent action with pus has been utilised for the detection of the latter in the urine, etc.; it is a very delicate test, and one which may, I believe, be relied on if the presence of

blood can be excluded. If blood is present in any appreciable amount, a similar effervescence takes place, and continues until the colouring matter and corpuscles are bleached and destroyed. But this action does not prevent the aqueous solution giving the blue tint with blood and guaiacum like the so-called "ozonic ether," it is moreover less expensive and more manageable than the latter. Its chief therapeutic value thus lies in its cleansing, antiseptic, and withal painless action upon foul and pus-secreting surfaces. Applied on absorbent wool as a swab or temporary dressing to venereal sores, foul or sluggish wounds, and purulent eczematous surfaces; used as an injection for abscess-cavities, purulent ophthalmia, otorrhœa, gonorrhœa, and leucorrhœa; used as a mouth-wash or gargle in cases of dental abscess or caries and simple stomatitis; or directly applied to ulcerated surfaces on the tonsils and pharynx, and as a douche or injection in ozæna (the crusts having been first removed), it has yielded most satisfactory results. Not only is it painless in itself, but I have noticed cases of painful and irritable ulcer in which during its application the pain notably abated: this result may possibly be attributable to the local anæsthetic action of the gas evolved during effervescence, for when the fluid acts on pus, carbon dioxide appears to be set free.

Many other openings for its use will suggest themselves; thus it may be hopefully tried as a lotion for washing out the bladder and the stomach in certain cases, and as a topical application in membranous diphtheria. Mixed with glycerine and applied on a tampon of absorbent wool to the ulcerated cervix uteri, it yields satisfactory results. On removing the tampon a few hours afterwards the ulcerated surface is found quite clean and free from discharge, and already wearing a more healthy appearance.

There is always some danger of overpraising a remedy which has proved recently and generally successful, with the result of thereby ultimately bringing upon it unmerited reproach. Such a danger I desire to avoid; and without incurring it I may be allowed to recommend to practitioners the use of a therapeutic agent which from my own experience I know to possess powerful antiseptic properties, and moreover is colourless, odourless, cleansing, and stimulating, does not stain or corrode, destroys pus, causes no pain in its application, and is not poisonous.

Reviews.

Elements of Pharmacy, Materia Medica, and Therapeutics. By W. Whitla, M.D. Second Edition. London: Renshaw & Co. 1883.

The rapid sale of the first edition of this work has shown how much it has been appreciated. This edition has been enlarged by nearly eighty pages, and revised. The part containing the non-official remedies has undergone considerable changes, and the author seems to have used great care in collecting and arranging his notes on this head. The high standard attained by the first edition is not only maintained but surpassed.

Our Homes, and How to Make Them Healthy. Edited by Shirley F. Murphy. London, Paris, and New York: Cassell & Co. 1883.

This work constitutes the most complete account available of all that tends to insure both health and comfort in connexion with dwelling-houses. It has been compiled by sixteen experts, each one dealing with the subject with which he is most conversant, and in entering upon their task the compilers have succeeded in fulfilling the intention which—according to Dr. B. W. Richardson, who introduces the work by a prefatory article—they held in view, namely, to raise the ordination of the house to the rank of a science—the science of domestic sanitation. A healthy house is shown to be one which should present no facilities for holding dusts; it must possess every facility for the removal of its impurities as fast as they are produced; it must be free from damp; it must be well filled with daylight, but without glare; it must be charged with pure air in steadily changing current; it must be maintained at an even temperature, and must be free from draughts; and it must be charged with an efficient supply of wholesome water. In pointing out how all these and many other incidental requirements may be carried into effect, the aid of the several branches of science has been invoked. The architect enters into details as

to site, soil, structure, arrangement of houses on site, and of rooms in houses, fittings, etc.; and this part of the work is well carried out by Mr. Gordon Smith, whose experience as to these matters is very wide indeed, and by Mr. Keith D. Young. Mr. Edis supplements this portion of the work by an article on internal decorations, floors and walls, and their coverings. Engineers expound all the recent information as to the best methods of supplying houses with water and so arranging the drainage that all danger from the escape of sewer air into dwellings shall be avoided; this portion of the subject being dealt with by Mr. Rogers Field, Mr. W. Eassie, and Mr. Wallace Peggs. In connexion with the subject of warming and ventilation an exhaustive article has been prepared by Mr. Douglas Galton, F.R.S., who has succeeded in summarising almost all that he has before written on a subject with which he is so specially acquainted. The medical aspect of these several subjects is brought out by Dr. de Chaumont, F.R.S., who deals with the relation of water to health and disease, and with the influence of the various forms of filters in rendering water more wholesome; by Dr. Corfield, who discloses the special dangers to health in connexion with faulty means of drainage, and the principles to be held in view for their prevention; by Mr. Malcolm Morris, who brings the information as to arsenic in wall-papers and in paint up to current date; by Dr. W. Squire, who devotes himself especially to the health requirements of nurseries, and the methods in which the needs of sick children may best be provided for in their own houses; and by Mr. Brudenell Carter, who takes up the question of lighting. Mr. Carter's article is one of exceptional interest, quite apart from the question of dwellings. He commences by acquainting the reader with the principles of optics as a science, in so far as this is necessary for the purposes he has in view; he explains the physiological influence of light, and then he proceeds to discuss all the various methods by which daylight and artificial light may be best utilised. The respective advantages of electric light and gas light are entered into, and the influence of electric light upon animal and vegetable life is explained. Plants are alleged not to have suffered from exposure uninterruptedly and continuously, without their usual nightly rest, to the influence of either sunshine or electric light; but it may be taken for granted that if man were for long periods subjected to the influence of the violet and ultra-violet rays which operate only during sunshine or as the effect of electric light, and which involve an increase in the intensity and rapidity of chemical change in the body, and of the vital action correlated to it, the effect would be towards the premature exhaustion of life. The various forms of gas-burners and the advantages attaching to

them are fully discussed, as are also all the recent inventions in connexion with gas-lighting, together with their influence in securing comfort and health in the house. The practical advice given is opposed to the use of gas in houses, and it is specially pointed out that gas-lights should not be resorted to in the case of bedrooms. In one sense it is more dangerous to health to leave a small glimmer of gas burning in a bedroom than to turn the flame on full, for the imperfect combustion which is an incident of a small flame loads the air with partially burnt hydro-carbons and other noxious products. The editor himself contributes an article on the various methods for dealing with excreta by means of dry closets, and he brings to bear his experience as a medical officer of health on the requirements for the sick-room, whether for ordinary or for infectious diseases. Phillis Browne, under her *nom de guerre,* takes up the question of house-cleaning, and Mr. T. E. Gibb explains the legal liabilities of householders. In short, it would be impossible to conceive of a work more fitted to supply the public with all the information they need in order to combine health and comfort in their homes, and at the same time to impart to the reader scientific and skilled advice with respect to every detail of home life. Every point that can arise is well and clearly treated, from the first stage in the construction of the dwelling to the last finishing touch needed as regards the internal fittings for its several apartments and out-buildings.

Clinic of the Month.

The Micro-organism of Osteomyelitis.—Dr. Rosenbach has just published an account of his researches into the micro-organisms of osteomyelitis. Assuming that the specific microbe was to be found in company with those causing putrefaction, and with a view to ascertain whether they could give rise to a local ostitis without the occurrence of previous local injury, he began by introducing the microbe of lactic acid fermentation into the auricular vein of a rabbit, and found that no result occurred unless there was previous local injury of the bone. But necrosis and acute osteomyelitis were at once produced if such local injury existed. However, as the same result was attained by the introduction of any other septic material, and moreover, the microbe of the osteomyelitic pus failed to produce lactic fermentation under suitable conditions, it was considered that there was no causal connexion between the disease and this peculiar microbe. The author has obtained by cultivation of osteomyelitic micrococci on nutritive gelatine an orange-coloured or reddish microbe, which finally caused liquefaction of the gelatine, but had no such effect upon sterilised fibrin and peptone cultivation fluid. This micrococcus was characterised by a staphyloid arrangement of the individual cells. Is this micrococcus a specific excitant of osteomyelitis? If so, then osteomyelitis will be produced without previous lesion of bone. In animals it does not excite osteomyelitis, but it does cause death with the usual septic lesions. Further, the orange-coloured staphyloid micrococcus has been produced by culture from the following sources, viz. abscess of lymphatic gland following on eczema capitis, in thirty-five cases; from subcutaneous and deep abscesses, in seventeen cases (five cases of empyema, two cases of boils, five cases of pyæmia, five cases of septicæmia); and from fourteen cases of osteomyelitis. In another case it was combined with a micrococcus of similar arrangement, but lighter in colour, which he called *Staphylococcus pyogenes albus.* Rosenbach has further shown that this micrococcus produces violent phlegmonous inflammation when intro-

duced beneath the skin. In fifteen cases of fracture, osteomyelitis was produced in eleven cases by the subcutaneous injection of this micrococcus. The author is led to the conclusion that there is nothing specific in the characters of his orange micrococcus or *Staphylococcus pyogenes aureus.* Becker (*Deutsche med. Wochenschrift,* 1883, No. 46) gives, as a further character of this orange-coloured micrococcus, the presence of a peculiar odour, resembling that of spoilt dough, and produced by exposure to the air. He never saw osteomyelitis produced by this micrococcus without previous local injury of bone. (*Centralblatt f. Chirurgie,* Feb. 4, 1884.)

Three Forms of Innocent Bronchocele.—Woeffler gives an account of three forms of innocent bronchocele, and endeavours to identify that particular form which is benefited by injections, inunctions, &c. They are: (1) Fœtal adenoma, characterised by the development of numerous nodular neoplasms in the glandular tissue, causing pressure and atrophy. The nodules are easily shelled out, and may be easily detected and diagnosed by palpation. This form is not benefited by local treatment. The use of the knife is uncalled for, as the growth seldom produces any inconvenience. (2) Gelatinous bronchocele is characterised by the formation of gelatinous material, and the new formation of cells is confined to one or other lobe; it is distinguished from cystic bronchocele by its more viscid contents, and the presence of fibrous septa and its globular form. It appears later in life than the fœtal adenoma, viz. between the ages of twenty and fifty. (3) The so-called intra-acinous adenoma is confined to the anterior portion of the gland, and is simply an interacinous hypertrophy. It is frequently combined with the preceding form, and is very amenable to treatment by injection in its earlier stages. (*Wiener med. Woch.* 1883, No. 43.)

Acute Gonorrhœal Rheumatism.—In a paper on this subject in *Guy's Hospital Reports,* vol. xli., Mr. J. N. C. Davies-Colley suggests that there are several distinct affections confused together under the name gonorrhœal rheumatism, which he enumerates as follows:

1. *Gonorrhœal synovitis,* a chronic affection, occurring in the male, generally in the knee-joints. Very rarely it is acute, and goes on to suppuration.

2. *Gonorrhœal arthritis,* an acute affection, occurring in the female quite as often as in the male; as a rule attacking at the outset several joints, and afterwards confined to one, most frequently the elbow-joint, affecting especially the fibrous tissues of the joint, and only secondarily the synovial membrane and cartilages.

2. *Gonorrhœal inflammation of fibrous structures not connected with the joints, e.g.*, the plantar fascia, sclerotic, iris, the pericardium, and endocardium ; this gonorrhœal inflammation of the plantar fascia sometimes occurs in the acute form. Inflammation of the first three structures usually occurs in connexion with chronic gonorrhœal synovitis. In the last two situations inflammations seem to be generally associated with gonorrhœal arthritis.

With regard to the second class, he says: (1) It usually occurs during the acute stage of gonorrhœa, or some purulent discharge from the genital organs, in adult patients under middle age. (2) It occurs as often in females as in males, if not more often. Of twelve cases recorded by the writer, nine were in females. (3) It may attack any joint, but most often the elbow-joint. Eight of the writer's twelve cases were in the elbow. (4) At first it attacks several joints, like acute rheumatism, and then confines itself, as a rule, to one. (5) Its seat is the fibrous tissue of the joint. There are great œdema, redness, pain, and tenderness. The ligaments are softened, and the cartilage may be disorganised. There is but little synovial effusion, and constitutional disturbance is but slight. (6) It may be confounded at first with acute rheumatism, later on with phlegmonous erysipelas, bursitis, lymphangeitis, phlebitis, gout, and pulpy disease of the synovial membrane. (7) It rarely, if ever, suppurates, but is especially prone to set up fibrous ankylosis. (8) The best treatment is to cure the discharge, keep the joint perfectly still, and apply uniform pressure as long as the acute stage lasts, and then to use passive motion.

Kairin as an Antipyretic.—In the first communications made by Dr. Filehne regarding the action of this antipyretic, he stated that its action was very temporary, and that the temperature very quickly rose with renewed rigor after a short depression. These rigors caused great discomfort to the patients. There are at least two kinds of kairin, M kairin (hydro-oxymethylchinolin) and A kairin (hydro-oxyethylchinolin). The first experiments were made with M kairin, and the results of those made with A kairin were much more satisfactory. Dr. G. Merkel has tried it in three cases of phthisis, three of croupous pneumonia, one of pleurisy, one of endocarditis, one of anæmia, one of scarlet fever, and nine of typhoid fever. The conclusions which he draws from his observations are that A kairin is exceedingly powerful, though not the most powerful antipyretic for internal use. It lowers the temperature in fever of all sorts, but the extent of the depression does not depend only on the amount of the dose, but depends also to a more important extent on the constitution of the patient and the cause of the fever. The

depression generally occurs without collapse or any other disagreeable concomitant, and is well borne subjectively. If the depression is to be permanent, the first large dose must be followed by several small ones; the size and number of each can in many cases be tested once for all. The occurrence of rigors or chilliness cannot be used as an indication in many cases, because they are often absent, even when the temperature rises quickly. In many cases the number and size of the doses can only be determined from day to day by measurement of the temperature, and this ought to be frequently taken. The diseases in which kairin, like all other antipyretics, is most useful, are those with continued fever in which heart and lungs are not primarily affected. Kairin seems to have no action on the circulation, though this point would require still more careful testing. The average dose in cases of typhoid was six grammes per diem, and with the present price of quinine, the expense of treatment with kairin was nearly double that of quinine. Trials with a combination of quinine and kairin appeared to have a very favourable result, but they were too few to draw any definite conclusion from them. (*Deut. Archiv f. klin. Med.* vol. xxxiv.)

Site of the Thermic Centre.—Dr. Lemcke describes a case of acute apoplectic bulbar paralysis in which there was a remarkable sinking of the temperature. A post-mortem examination showed that a hæmorrhage had occurred in the medulla oblongata about three millimetres to the left of the middle line. Its length was about four millimetres extending from the middle of the olivary body to the point of the ala cinerea. At its lower end it lay a millimetre and a half beneath the floor of the fourth ventricle, at its upper end it was close under the floor. Its breadth was from one to one and a half millimetres. It lay outside of and above the nucleus of the vagus and to the inside of and rather below the superior nucleus of the auditory nerve. (*Deut. Archiv f. klin. Med.* page 84, vol. xxxiv.)

Symptoms on the sound side in Hemiplegia.—M. Dignat in some recent lectures on this subject draws attention to the fact that while some muscles (of the larynx, eyeballs &c.) on the affected side almost always escape, conversely motor and nutritive abnormalities not unfrequently show themselves in a minor degree on the same side as the brain lesion. In the upper extremities, the only bilateral change as yet demonstrated is diminution of muscular force, which commonly amounts to 38·5 per cent. by the dynamometer, on the side of brain lesion. Reflex and other vital functions are unimpaired on this side. The weakness progresses as death approaches, and becomes less marked, though never quite remedied, in the event of recovery.

In the lower extremities the following changes are common to both limbs from the first, or become so. (1) Muscular power is lost on the apparently normal side, co-ordination being intact in a greater degree (50 p.c.) than in the corresponding arm, and sometimes even than in the opposite leg; but in the process of recovery it is more rapidly regained than it is by the latter. (2) Co-ordination of movements is impaired in some cases on the side of brain lesion as well as on the opposite. Patients of this class can move the less affected limb in every direction while lying, but cannot use it in walking or even in standing—though the muscular power may be good. The power of co-ordination necessary for maintenance of equilibrium and for progression is lost. In other cases co-ordination is perfect in this limb while muscular energy is poor. This is the more common condition. (3) Rapidly formed bed-sores are apt to appear in the unparalysed limb, usually after the paralysed one has developed this condition. In one case of white softening in the right centrum ovale, bed-sores formed in both extremities at the same time (Charcot). (4) Exaggeration of the reflex characteristically present on the side of hemiplegia is frequently perceptible in the opposite leg, and is occasionally as marked in the latter as the former, though usually it is less so. This phenomenon, formerly believed to mark the advent of degenerative change immediately prior to contracture, has already been observed by MM. Westphal and Claus, and now by M. Dignat, to occur at the time of the primary cerebral shock, and to be sometimes simultaneous in both lower extremities. (5) Epileptoid tremor produced in the leg by flexion of the foot at the ankle. Like the exaggerated knee reflex it comes on sometimes with the stage of secondary contracture, sometimes immediately after the primary hemiplegia, and may arise on both sides simultaneously. It may even be present in the apparently sound limb while absent in the paralysed extremity, as in a case cited by M. Dignat. The above observations were fully illustrated by cases. M. Dignat added the following explanations. (1) The diminution of muscular power on the side of brain lesion is probably due to functional reaction by shock of that injury on the motor centres of the opposite hemisphere with which its own has communications. (2) The bed-sores are due to some similar trophic alteration. (3) Exaggerated tendon reflex results from functional changes which increase the medullary excitability. (4) Secondary contracture and other permanent motor affections, when bilateral, are due to degenerative changes in both halves of the spinal cord. They are limited to the fibres which supply the lower limbs. They occupy in some cases both lateral columns (Pitres), in others the lateral column of the hemiplegic side and the inner part of the anterior column of that opposite

(Turck). The former observation bears out the view that the lateral columns of the cord do not always cross, *en masse,* to opposite sides of the brain at the decussation of the pyramids as stated by Turck, but that part of one occasionally passes to the hemisphere of its own side without crossing. Hence an injury to this hemisphere gives rise to marked paralytic changes in the muscles supplied by the opposite lateral column and to the same in a less degree in those connected with the lateral column on the side of injury. (*Progrès médical,* Sept. 29, Oct. 6 and 13, 1883.)

Cystic Tumour of the Orbit cured by Electrolysis with restoration of impaired Vision.—Mr. Thompson of Indianopolis reports a case of cystic tumour of the eye in a child of five years of age. The tumour in growing had caused the left eye to protrude downwards and outwards and materially impeded its movements. The growth could be plainly seen above the tendo oculi and behind the upper eyelid. The vision was reduced to $\frac{20}{50}$ or below one-half the normal amount. The fundus was natural when examined ophthalmoscopically and there was slight hypermetropic refraction. There was no diplopia. The swelling remained stationary for a few weeks, but the parents were informed of the serious nature of the case and that the eye would probably have to be sacrificed. Electrolysis was determined upon as a preliminary proceeding with the hope of saving the eye. The child was etherised and a trocar introduced nearly two inches into the growth. On its withdrawal about three drachms of dark-looking fluid followed. As soon as this ceased to flow through the cannula the latter was connected with the positive pole of a Stöhrer's galvanic battery with twenty cells in action, and the current was closed with a covered moistened negative electrode on the corresponding temple. The current was allowed to pass for some minutes. On withdrawing the cannula, which was rather difficult owing to its adhesion to the tissues, it was found to be nearly eaten through in several places. Considerable oozing of fluid took place after the termination of the operation. Iced applications were used for some days to control the severe inflammation that followed. The eye, one month after the operation, had nearly resumed its normal position, its motions were perfect and the vision was $\frac{20}{30}$. (*Archives of Ophthalmology,* p. 183, vol. xii.)

Rarer Sequelæ of Typhoid Fever.—In a mild case (a cook, æt. 28), the temperature in typhoid fever rose to 105° by the eighth day, and gradually fell under large doses of quinine sulphate to 98° by the twenty-second day; after that pains and tenderness in the right thigh began, which grew gradually worse and worse, the colour of the thigh became flushed and

dull, its surface became hot, sweating abundantly, and slightly œdematous; and the circulation through the posterior tibial artery almost entirely obstructed. After a fortnight's treatment with Fotus opii the pain gradually disappeared, and the cyanosis and œdema began gradually to subside, until about a month later the patient was able to walk in an elastic stocking. The symptoms were not due to a vascular paralysis, but to the slow advancement of an endarteritis, which was much more gradual than the usually rapid onset of an embolism. A shopboy, N. L., æt. 18, passed without complication through the first three weeks of typhoid fever; but in the fourth week, when the temperature had nearly sunk to normal, began to feel pain in the right shoulder and arm, which came on more and more severely night after night. The pain was of a bruising or tearing character, felt deep down in the muscles without any tenderness, and unlike any lancinating pain in the course of the nerves; it led to paralysis of the right shoulder first (especially of the deltoid), and then of the arm or fore-arm, without any abnormality of sensation. The effect of faradisation on the right shoulder was much less than on the left, and the right deltoid rapidly atrophied and ceased altogether in ten days to react to faradisation. There were no other symptoms of spinal injury; no pains in the back, no tenderness of the vertebral column. The muscular pains were undoubtedly produced by an inflammation of the anterior grey cornua in the cervical region of the spinal cord—an inflammation in some ways analogous to that of infantile paralysis, but less sudden. It is true that pain in such cases of poliomyelitis is not the rule in either infants or adults, but is sometimes in both found to occur, repeated every night. The absence of inflammation of the meninges was shown by the absence of tenderness of the vertebræ, of increased reflex action, and of tendency to contracture. When early in the case the deltoid was found to be wanting in reaction to an interrupted current, it could be prophesied that atrophy would follow at least for a time; but that the atrophy should be permanent could not be certainly foreseen, as M. Vulpian quotes two cases where atrophy had followed a secondary attack of poliomyelitis in acute illness, but in which there had been slow recovery from the atrophy. (*Révue de Médecine*, p. 617, 1883.)

General Atrophy following Diphtheria.—Cahn relates a case of paralysis of the œsophagus throughout its whole extent, which followed on a mild case of diphtheria, and which disappeared successively from above downwards. Great emaciation, whose cause was assigned to derangement of the trophic nerves throughout the body, occurred; for, though nourishment was consumed by oxidation in the body, it was not assimilated,

as experiments proved. The patient finally completely recovered. (*Berl. klin. Woch.* 1, 1883.)

Cirrhosis of the Lung.—Amburger describes the symptoms of diffuse cirrhosis of the lung not consequent on acute fibrinous pneumonia as follows:—An individual, generally over thirty years of age, who has hitherto had no pulmonary disease, complains of vague general illness, and soon afterwards of dull pain on one side of the chest, and frequently of slight cough. Carefully taken records of the temperature may awaken suspicion of interstitial pneumonia. The first evident symptom is subacute pleurisy, which is localised, is accompanied by a very little fever, and by no fluid exudation. The patient still appears free from fever, but careful observation will frequently show some febrile temperature, and the consolidation of the lung gradually occurs. The patient still does not feel well, and a feeling of health returns in startling contrast at the time when definite signs of an alteration in the thoracic organs are observed. Pathognomonic physical signs now gradually become more evident, the healthy lung expands in a compensatory fashion and is pulled over by the collapsing lung. The heart is either dislocated to the right side or laid bare by the retracting lung. If the patient carefully avoids catching cold, takes light food, and has pure air, the prognosis is good, not only as regards life, but as regards ultimate recovery. Counter-irritation is useful in treatment, but the application of too much cold to the surface by baths or walking in too cold air is to be avoided. (*Deut. Archiv f. klin. Med.*, page 508, vol. xxxiii.)

Febricula as an Infective Disease.—Febricula is usually looked upon as the consequence of a chill. It generally begins suddenly without any prodromata, by well-marked rigor or by repeated chilliness. The patient feels ill and complains of headache, great languor, and frequent pains in the limbs. This is succeeded by a feeling of heat, and the face becomes flushed. The temperature rises quickly, and not unfrequently attains 104° or more. The pulse is full and rapid, 100 to 120. The tongue is thickly coated, appetite is gone, and there is much thirst. There is generally slight constipation, but sometimes diarrhœa. The urine is scanty, and deposits a copious sediment. All the symptoms generally disappear rapidly with copious perspiration, and frequently with the appearance of labial herpes. The pulse and temperature quickly fall to the normal. There is generally no eruption, though Griesinger states that he has occasionally found small, somewhat livid roseolar spots. All the symptoms, headache, languor, loss of appetite, thirst, pains in the limbs, scanty urine, copious sweats and herpes, may be regarded as simply symptoms of a febrile condition. Dr. Plessing

considers that the febrile condition may be due to a number of causes, and he therefore thinks that febricula should be looked upon not as a single disease, but as a group of diseases. From its occurring in groups of people, he thinks that one form of it at least is probably an infective disease. What the nature of the virus is, it is impossible at present to say, but it appears that the poison is not so virulent that a healthy person cannot quickly excrete it without further injury. The poison appears not to cause any enlargement of the spleen. He thinks that it is not so much a contagious as a miasmatic poison. The time of incubation is uncertain: the minimum time from his cases is two and a half days. As a general conclusion from his observations he would distinguish from the large febrile group a sub-group, infectious febricula (*febricula infectiosa*). (*Deut. Archiv f. klin. Med.*, page 159, vol. xxxiv.)

Inoculation with Gonorrhœal Micrococci.—Bockhardt has performed a successful inoculation of gonorrhœa by means of a cultivation-fluid of peptone and gelatine containing micrococci. The micrococci were of the fourth generation, and the subject, a paraplegic patient aged 47, died ten days after of intercurrent hypostatic pneumonia. The urethra was found full of a sanious purulent matter, for the last six inches of its length. It was stained with methyl-violet, and sections were examined microscopically with the following results. (1) The "gonococci" are the pathogenic bacteria of gonorrhœa. (2) When in contact with the mucous membrane they penetrate the lymph-passages of the mucosa and submucosa of the fossa navicularis in order to proliferate, and cause inflammation and diapedesis of leucocytes. (3) They enter the leucocytes, which they finally destroy. The leucocytes pass into the blood-vessels and connective tissue of the mucosa and cavernosa penis towards the bladder, and are destroyed by bursting, setting the gonococci free. To this it is objected that the cocci are not stored up in the leucocytes, as Bockhardt states. He mistakes the "nutritive cells" containing numerous nuclei, which are found in the discharge (and which he does not mention) for leucocytes containing cocci. He states that gonococci are never found lying on the epithelial cells. which are in an active state of proliferation in gonorrhœa. It is objected to this that in chronic urethritis they are found in heaps lying upon them. It would, in any case, be more simple to suppose the large heaps of cocci to be formed by deposit from the fluid, than by the bursting of the leucocytes containing them. [*Pract.* xxx. 147] (*Sitzungsberichte d. Würzburger Gesell*, 1883.)

Action of Atropine and Eserine on the Intraocular Pressure.—Dr. Graser has made a number of experiments on intraocular pressure by inserting a fine cannula into

the anterior chamber of the eye, and registering the pressure by means of a small manometer. This method, he thinks, is the only one by which accurate results are to be obtained. He finds that the height of the intraocular pressure depends upon that of the blood pressure. The movement of the iris has a distinct influence on the intraocular pressure; dilatation of the pupil increasing and contraction of the pupil diminishing it. Atropine applied to the conjunctiva, in the dose generally used to dilate the pupil, increases the intraocular pressure. Eserine applied in a similar manner first causes a rise in pressure, but in all cases in less than an hour after myosis is developed it produces a fall of intraocular pressure below the normal. (*Archiv f. exper. Path. und Pharm.*, p. 329, vol. xvii.)

Disease of the Sympathetic Plexuses in the Intestine.—Dr. Bloschko has found in a case of atrophy of the intestine disease of the ganglion cells and fibres both of Auerbach's and Meissner's plexuses. The symptoms he describes were loss of appetite with occasional diarrhœa, continuous vomiting, and pain over the epigastrium. The vomited matters and stools were very fœtid, and there was fœtor of the breath and bleeding from the gums; the patient became comatose and died. The intestine was exceedingly thin, and the villi were diminished and the surface studded with small black points; the ganglion cells, as already mentioned, were in a state of fatty degeneration. Maier found in animals poisoned with lead a condition not unlike the present. He described a sclerotic degeneration of the ganglion cells with development of connective tissue, and appears to have noticed also a kind of fatty degeneration of the ganglion cells. The difference between the condition in lead poisoning and the one observed by the author consisted in the absence of any increased connective tissue around the ganglion cells. The anæmia, weakness, and death appeared to be due to a complete failure of absorptive power in the intestine, so that absorption was performed only by the stomach. (*Virchow's Archiv*, p. 136, vol. 94.)

Diagnosis of Disease of the Stomach.—Professor Leube recommends, as a diagnostic measure, that a soft india-rubber tube should be passed into the stomach and its contents examined at various periods of digestion. A meal consisting of soup, a large beef-steak, and a piece of white bread, is completely digested by a healthy stomach in seven hours, so that if it was washed out at the end of this time the fluid comes back clear, or mixed only with a few flakes of mucus. Leube recommends that this should be done at the commencement of the treatment in every case of gastric disease, with the exception of those where the disease is likely to terminate of itself in a few days, or where

there is a tendency to bleeding, as in gastric ulcer or pernicious anæmia. He regulates the treatment by the result he obtains. If the fluid returns clear it is evident that the stomach digests in the normal time, and if dyspeptic symptoms are present it is probably gastralgia, or nervous dyspepsia, perhaps even ulcer. In order to ascertain the power of the stomach to secrete gastric juice he washes it out with warm water until the water returns neutral, then pours in 50 centimetres of 3 per cent. soda solution, and leaves it 12 minutes in the stomach. He then introduces 500 centimetres of lukewarm water, and tests the fluid which returns. If the stomach is normal the gastric juice should neutralise the soda, and if the fluid returns strongly alkaline the secretion of gastric juice is deficient. The healthy stomach is also stimulated by thermal irritation, and Professor Leube uses this method by injecting 100 centimetres of ice-water into the empty stomach, and washing it out with 300 centimetres more water after ten minutes. Generally, though not always, the water thus obtained from a healthy stomach contains both acid and pepsine. In chronic dyspepsia the water remains neutral, and has no digestive action. In cases of purely nervous dyspepsia the result is the same as in healthy stomachs. A very remarkable result was observed in a case of uræmia, in which, notwithstanding great disturbance of digestion, the functions of the stomach were readily and perfectly performed, and not only was the meal completely digested in the normal time, but the secretion of gastric juice was exceedingly rapid. It is therefore probable that the gastric disorder in uræmic conditions is due chiefly to nervous disturbance. In cases of severe dyspepsia not of a nervous nature the digestion of a meal is almost always delayed, and the fluid removed after the injection of soda or ice-water is almost without exception free from acid and pepsine. The author directs attention to a peculiar form of dyspepsia due to malaria, and which is cured quickly and permanently by quinine. In one case the disease was treated for months with all kinds of diet and mineral waters in vain, until a tertian type became evident in the dyspepsia, and quinine quickly cured it. In another case, a patient who had formerly suffered from ague had loss of appetite and sickness in the morning. In the evening it was better, and the patient could take the most indigestible food without difficulty; 7½ grain doses of quinine cured all these symptoms in four or five days. (*Deut. Archiv f. klin. Med.*, p. 1, vol. xxxiii.)

Diagnosis of Pleural Disease.—As affording diagnostic differences between pleural exudation and cancer Dr. Purgesz mentions three symptoms: (1) In cancer there is œdema of the chest-wall over the site of the cancer. (2) Notwithstanding

the greater circumference of the diseased side, and the displacement of the heart, the pleura is not depressed. (3) The intercostal spaces, instead of being widened as in pleurisy, are rather narrower than usual. (*Deut. Archiv f. klin. Med.*, p. 616, vol. xxxiii.)

Veratria in Muscular Tremor.—After small doses of veratria each muscle when stimulated reacts more vigorously, and the contraction lasts longer than in the normal condition. The increased duration of the single contraction is shown not only by the greater length of the myographic curve, but also by the fact that while thirty stimuli per second are needed to set a normal frog's muscle into tetanus some ten suffice to tetanise the veratrised muscle. The tremors of alcoholism, of central nerve-degeneration, of fever, &c., are due, according to Dr. Feris, to a condition of muscular contraction in which the impulses are not sufficiently rapid to give rise to tetanus. This may be owing to defective innervation as well as to muscular degeneration. Dr. Feris has used veratria in such tremors, giving it in pills of half a milligramme each ($\frac{1}{120}$ grain), of which four were taken daily at intervals of an hour. Of thirteen patients so treated ten were suffering from alcoholism, two from disseminated sclerosis, one from sequelæ of typhoid. In all the tremors disappeared entirely in five to fifteen days. Improvement appears after the first day, as is shown by making the patients write before and (one hour) after each pill. The treatment should be kept up for ten days at least, or relapse may occur. The cases have continued well for two months at least after the veratria was stopped. (*Société de Biologie*, No. 26, 1883.)

Extracts from British and Foreign Journals.

Diseases of the Eye in Pregnancy.—M. Metaxas, in a memoir on this subject, remarks that pregnancy may manifest its influence on most of the membranes of the eye, and that this influence may either be slight and transitory or may lead to complete loss of vision. The *conjunctiva* may be the seat of simple inflammation or of ecchymosis, and it may participate in the inflammation of other parts. The *cornea* is sometimes the seat of ulceration with hypopyon, resembling that which is often met with in cachectic states of the system, and may, like it, terminate in perforation and loss of the eye. The *iris* sometimes becomes inflamed; but, as a general rule, without causing serious trouble, except when the inflammation spreads to the choroid. Weakness of the *ciliary muscle*, or accommodative asthenopia, which is common amongst hypermetropic women, appears to be due to a special weakness affecting this muscle. Opacity of the *lens*, or cataract, may be due to the cachectic state of certain women, whilst in other cases it may be attributed to hæmorrhages after accouchement. Puerperal *irido-choroiditis* is, in general, suppurative, leading to panophthalmitis and total loss of the affected eye. Hæmorrhagic glaucoma, of which affection Metaxas reports two cases, is due to the high tension which exists in the arterial system during pregnancy, and a similar ætiology is attributable to retinal emboli and miliary aneurisms. Detachment of the retina is often the final stage of pre-existent lesions in this membrane or in the adjacent parts. Hemiopia and scotomata, when there are no ophthalmoscopic lesions to which these are referable, may be regarded as the result of encephalic disease or to simple disturbance of the intra-cranial nervous system. Optic neuritis, and the papillary atrophy which is often the consequence of it, are probably due to the congestions which are so common in pregnant women. Lastly, in some cases amaurosis has been observed when the most careful ophthalmoscopic observation has failed to discover any lesion. It is difficult, M. Metaxas remarks, to give any explanation of the frequency of lacrymal affections during

pregnancy and child-birth, and various opinions have been hazarded, none of which are of general application. [*Practitioner*, xxx. 465.] (*Recueil d'Ophthalmologie*, Nov. 1883.)

On Intrapleural Tension.—From manometric experiments J. Schreiber finds that the negative pressure in the pleura may be as great as 90 millimetres of mercury. This is considerably larger than the values of former observers, and shows the necessity for using a longer tube than they recommend when the thorax is aspirated by a syphon. For if the indiarubber tube is only one metre long, the column of water it contains corresponds to 73 millimetres of mercury, and air will therefore be drawn into the thorax in cases where the negative pressure is great. The elastic tube ought to be not less than 122 centimetres (a little over four feet) and for greater safety, its under end should dip into a disinfecting fluid. (*Deut. Archiv f. klin. Med.* p. 485, vol. xxxiii.)

The Action and Use of Cotoine and Paracotoine.—The coto bark has been used in diarrhœa, and as it has no proper astringent action, its utility has been ascribed to an antiseptic action by which it diminishes the formation of irritating products in the intestines. Professor Albertoni has investigated the action of the coto alkaloids, and finds that although cotoine somewhat lessens putrefaction and the development of bacteria, it does not stop them either in the organism or outside it. He finds, however, that it has a very peculiar action on the vessels of the intestine. By keeping up artificial circulation in a loop of intestine by the method employed by Ludwig and Salvioli he was able to estimate precisely the rôle of the blood flow.

Cotoine dilates the arteries, causes the blood to flow more readily into the veins, and preserves the vitality of the intestine. It also dilates the vessels of the kidney, and causes the blood to flow more rapidly through them. When injected into the jugular vein it produces an active hyperæmia of the intestine, but does not alter the circulation in the submaxillary gland. It causes the temperature of the peritoneal cavity to rise.

Opium and chloral also dilate the vessels of the intestine, but their action is a paralysing one, while that of the cotoine is not. The action of paracotoine is similar to that of cotoine, but less marked.

Coto bark has been used in the form of powder and tincture in various kinds of diarrhœa, such as that occurring in rickety children, in typhoid fever, in intestinal catarrh, and in phthisis. Albertoni has employed it with good results in diarrhœa occurring in the insane, although it was of little service in advanced cases of general paralysis. In chronic intestinal catarrh he has

found it exceedingly useful, but it has been of no service in the diarrhœa of drunkards or in diarrhœa depending upon obstruction of the portal circulation, as in cases of cirrhosis of the liver. In the diarrhœa of phthisis he has found it exceedingly serviceable, though it does not always arrest it. In the diarrhœa of pellagra, cotoine proved curative when other drugs had failed. In diarrhœa of children he has found it useful, like former observers. A contra-indication of its use is a hyperæmic condition of the intestine and tendency to hæmorrhage from it.

Cotoine should be given in large doses—2½ to 3 grains; this is of special importance in treating diarrhœa in children. He gives it either as a powder or in solution; the powder is administered in a wafer, or mixed with some mucilaginous vehicle. For the solution he gives the following formula:—

Cotoine	0·40	grammes.
Bicarbonate of sodium	1·0	,,
Water	100·0	,,
Glycerine	20·0	,,

The mixture is to be warmed, the cotoine becoming nearly, though not entirely, dissolved.

The observations that he has made with paracotoine show that it has a similar action, though less powerful than that of cotoine. In regard to the mode of action he thinks that the benefit which cotoine produces in diarrhœa is due to dilatation of the intestinal vessels it causes, and the increased power of absorption which it gives. He considers that in many cases of diarrhœa diminished absorption is a most important factor.

A combination of cotoine with large doses of subnitrate of bismuth will probably be of great service. (*Archiv für exper. Path. und Pharm.* p. 291, vol. xvii.)

The Physiological Action of Antiseptics.—M. Laborde has lately completed the researches begun by MM. Gosselin and Bergeron (*Académie des Sciences*, 1877), on the local physiological action of antiseptic substances. He finds that these, for example alcohol and various forms of carbolic solution, besides arresting the formation of pus, directly encourage the coagulation of the albuminoid fluids which bathe the surfaces of a wound. They have a similar effect on the albuminoid contents of the neighbouring small vessels. These effects on the vascular contents are well seen on applying various antiseptic fluids to a frog's mesentery. Moreover, there is seen a vaso-motor contraction proportionate to the strength of the solution used, and this is followed by a dilatation of the vessels corresponding in degree to their former contraction. The general effect of these physiological changes is to place a check upon the inflammatory

reaction which occurs in healing wounds. If a strong solution is used and persisted in, there is danger of gangrene from the arrested blood-flow. To promote healthy action, weak or moderately strong solutions are necessary. (*Progrès médical*, Oct. 20, 1883.)

On Subcutaneous Injection of Iron.—Dr. Glaesecke has made a number of experiments on animals with iron salts, by injecting them subcutaneously into animals, and testing the amount of iron in the various organs by analysis. He found that the citrate of iron is most easily and certainly absorbed. It causes no local irritation at the point of injection, and the completeness of the absorption is seen by the fact that when the point of injection is examined microscopically after twenty-four hours, only traces of iron can be found in it. Ferrous sulphate is rendered easy of absorption by the addition of twice or three times its weight of citrate of sodium. Peptonised iron is badly absorbed, and ammoniated sulphate of iron is not absorbed at all. The greater part of the citrate of iron absorbed into the circulation is quickly excreted again, chiefly by the kidneys, and in small quantity by the liver; but a certain relation exists between the excretion by these two organs. The pancreas, the glands of the stomach and intestine, and the salivary glands, take no part in the excretion. The excretion through the urine begins about half an hour after the injection, is greatest in two to four hours, and is completely finished in twenty-five hours. Iron always occurs in the ferrous condition in the urine, in whatever form it may have been injected. Normal bile contains it in a ferric form, and the increase which occurs in its iron after an injection is generally ferric, though a trace of ferrous salt makes its appearance. As mere traces of ferrous salts occur in the bile, the author is inclined to think that iron occurs always in a ferric form in the body; the ferrous condition in the urine being due to reduction taking place. The serum of blood and the peritoneal fluid contained iron both in the ferric and ferrous form, in from one to six and a half hours after the injection. The aqueous humour never contained much, and the author thinks this is a proof that the iron exists in the body only in combination with albumen, which is absent from aqueous humour. The iron can be detected in the kidneys after its excretion has apparently ceased, and it may be found so long as three days after the injection. The appearances observed may be divided into two groups: the one occurring less than nine hours, and the other more than nine hours after the injection. In all kidneys the glomeruli are invariably free from iron. The appearances presented later on after the injection are simpler than those found earlier; in the former case

isolated contorted tubules, especially those lying near the surface, are found filled with iron, sometimes in the form of large lumps, which completely fill the lumen; in other instances it appears as granules. Earlier after the injection a greater deposit of iron is seen in the cortical substance, and also in the medulla. In this case the iron is not only contained in the lumen of the tubules, but in the epithelium also, in the form of fine black granules, which in the medulla always lie in that part of the cell nearest the lumen. A number of straight tubules and Henle's loops are plugged with masses of iron, and some of them exhibit a diffused green coloration of the epithelium with blackening of the nuclei. From these appearances it is evident that iron is excreted not by the glomeruli, but by the epithelium of the contorted tubules, in the same way as Heidenhain has shown to be the case with indigo-sulphate of sodium. The appearances in the liver also may be divided into two groups, corresponding to the time after injection. In the first nine hours, or less, after the injection, all the cells are diffusely coloured and granular; later on only the cells of the peripheral parts of the lobules are diffusely coloured without containing granules, and towards the end of the process of excretion only a few cells exhibiting such coloration are to be found scattered irregularly on the peripheral parts of the lobules. The author explains these appearances by supposing that the iron is first absorbed by the liver directly, as well as in a fluid condition from the blood-serum, and forms iron-albuminates with the albuminous bodies of the cell, and these take the form of fine granules. They remain only temporarily, and the iron again becomes soluble and is excreted with the bile. The subcutaneous injection of iron has no influence on the amount of iron in the spleen and in the medulla of the bones. In the treatment of patients the author has generally used citrate of iron. The subcutaneous injections should be made into the muscles of the back or of the nates; the needle should be sharp and the syringe always disinfected with carbolic acid. The solution of iron should be clear and not more than a month old. When these precautions are taken no unpleasant feeling is produced beyond a little burning lasting for about ten minutes, and a tenderness lasting for about twenty-four hours. The pyrophosphate of iron with citrate of sodium is not so good as the simple sulphate of iron. The dose for adults is one and a half grains, and the solution should be of the strength of 10 per cent. Larger doses cause symptoms of poisoning, namely, general discomfort immediately after the injection, with vomiting after twenty or thirty minutes, and languor for several hours. The result of this mode of treatment was very satisfactory, especially in one case of extreme cirrhosis, and one of anæmia due to bleeding from the stomach.

In cases of nephritis, however, the treatment was of little use. (*Archiv f. exper. Path. u. Pharm.* No. 6, vol. xvii.)

Therapeutical Uses of Nitrous Oxide.—On this subject Dr. Stanislaus Klikowitsch comes to the conclusion that pure nitrous oxide will not maintain respiration in man or animals, and, like other indifferent gases, produces death by asphyxia. The symptoms of asphyxia from this gas is distinguished by several characteristics from other kinds of asphyxia. Nitrous oxide produces no chemical or morphological changes in the blood of animals, but is simply dissolved in it and again excreted, while apparently it appears to undergo no decomposition into oxygen and nitrogen. The anæsthesia produced by pure nitrous oxide is so closely related to insufficient oxidation of the blood that it cannot be regarded as absolutely without danger, especially in diseases of the heart, lungs, and vessels. The admixture of 20 per cent. of oxygen with nitrous oxide completely removes the possibility of asphyxia and produces in the organism several effects, some of which may be applied with great advantage in therapeutics. Under the influence of a mixture of nitrous oxide with 20 per cent. of oxygen, the action of the heart in most healthy persons becomes quicker, the pulse waves smaller, and the respiration slower and deeper. After three to five minutes this effect disappears. In cases of weak cardiac action, this mixture has no unfavourable effect on the action of the heart, and if the rate of the pulse, as often happens, is somewhat diminished, it becomes larger and fuller. Such an effect on the circulation may last from one to two hours, or more. In cases of disordered innervation of the respiration the mixture regulates the respiratory rhythm, and quickly removes the subjective and objective signs of impaired oxidation of the blood. This mixture allays pain for a short time, and probably the rapid disappearance of attacks of angina pectoris after a few respirations may be thus explained: a mixture of 20 per cent. of oxygen with nitrous oxide is to be preferred to chloroform as a means of lessening the pains of normal labour; while vomiting and cough of reflex origin may be removed by a few inhalations of the mixture. (*Virchow's Archiv*, pp. 148 and 227, vol. 94.)

New Anæsthetic Method.—The experiments instituted some years ago by M. Paul Bert with regard to the production of anæsthesia by means of a mixture of chloroform and air have issued in certain definite results which promise to be of much service in diminishing the danger without materially lessening the advantages which attend the administration of that drug. He finds that in the case of dogs the physiological action and the chance of fatal consequences are reduced to a degree apparently

well within the limit of safety by the use of a mixture in the proportion of 25 grammes of chloroform to 100 litres of air—anæsthesia being complete. A proportion of eight per cent., after six or seven minutes, sufficed to induce and to maintain a state of surgical coma for fifteen to thirty minutes in six hospital patients of varying ages and of both sexes while under operation. The symptoms of the stage of exhilaration were much less marked than usual. Among other advantages which attend this new method may be mentioned the absence of the feeling of suffocation usual under the old system, in which a towel formed the means of administration; the face retains its natural colour; respiration is regular but somewhat quickened and sometimes snoring; the pulse shows no marked disturbance; buccal secretion is scanty, and the patient is spared those violent coughing efforts with which chloroformists are familiar and which often seem to initiate the after-vomiting. The return to consciousness from complete anæsthesia takes from eight to ten minutes. The quantity of chloroform used is small—in one case where anæsthesia lasted half an hour, it was only five grammes. By means of the apparatus adopted the patient escapes any local irritation of the skin, and the surgeon does not receive the fumes of the drug in his face. This appliance (the invention of Dr. H. Martin, originally used in analysing the gases of respiration, and referred to by Sir Spencer Wells in his *Diseases of the Ovaries*) consists of a pair of reservoirs connected with a caoutchouc mouth-piece, and containing the required mixture of air and chloroform. By a special contrivance, a constant supply of the anæsthetic is maintained to make up for the loss by inhalation. The pressure within the reservoirs remains under all circumstances equal to that of the surrounding air. The respiratory movements can be accurately watched by means of a water manometer and scale affixed to the instrument. In operations on the mouth, anæsthesia is first produced by the aid of the mouth-piece and afterwards kept up by an occasional jet of the mixed vapour sent into the back of the mouth. A case of removal of both superior maxillæ, under the care of M. Péan, proved the suitability of the method to such cases. (*Progrès médical*, Dec. 29, 1883.)

Urethral or Gonorrhœal Threads.—Dr. Fürbunger tries to determine the composition and significance of the short thread-like bodies frequently found in the urine after gonorrhœa, and usually called gonorrhœal threads. There are two kinds apparent to the naked eye: one is gelatinous, several millimetres to a centimetre long, varying in thickness from a hair to a knitting-needle, rarely split, and sometimes with a thick head. On taking them out with a needle they become elongated to

thin threads. The other form consists of opaque, yellow, brittle, and generally short threads and flakes, which have a tendency to break up completely on shaking the urine. On microscopic examination the most important constituents are round-cells and epithelium embedded in a gelatinous substance. Besides these, spermatozoa, red blood-corpuscles, various derivatives of cells, crystals, micro-organisms, and foreign bodies are met with. The round-cells form a great part, and are almost the only constituents of the threads observed shortly before and after acute gonorrhœa, and they also form the chief constituents of the yellow threads. Epithelial cells are not constant, and are generally, when present, much fewer in number than the round-cells. They may consist of stratified or cylindrical epithelium, and some of them colour very readily with iodine. These cells are, however, normal constituents of the urogenital mucous membrane. The colloid substance in which they are embedded consists chiefly of mucin. In regard to the conditions for the formation of these urethral threads, it may be stated that in any part of the urethra which is in a catarrhal condition and secreting mucus, so that the cellular exudation-products may be cemented together, these threads can be formed. Their diagnostic significance is somewhat difficult to determine. In the initial stage of acute gonorrhœa the epithelial cells in the threads are almost always large and flat from the localisation of the catarrh to the navicular fossa. In the final stage of acute gonorrhœa intermediate forms of epithelium occur from the implication of the posterior part of the urethra. While the discharge is considerable, threads are absent, because the formation of pus does not permit the cells to be cemented by mucin. So long as the gonorrhœal threads remain in the urine a slight cause may bring back the disease. The condition of the epithelial cells in gleet is not of the same diagnostic value as in gonorrhœa. The author thinks, however, a very small proportion of pavement epithelium in comparison to the intermediate forms present is a certain symptom of localisation of the disease in the posterior part of the urethra. Urethral threads may result from urethritis not due to gonorrhœal affection, but due to the passage of a catheter or to some other form of irritation, such as an alkaline condition of the urine. A third condition in which urethral threads occur is prostatorrhœa due to chronic prostatitis, not to hypertrophy of the gland. (*Deut. Archiv f. klin. Med.*, vol. xxxiii. p. 75.)

Surgical Uses of Collodion.—Mr. Sampson Gamgee writes: Collodion is one of those therapeutic agents of which the value to the surgeon is admitted, without being adequately appreciated or utilised. Composed of ether, gun-cotton, and

spirit, collodion is a powerful anti-putrescent; and, by ready evaporation and contraction, it exercises the dual antiphlogistic power of refrigeration and compression. In acute orchitis I know no plan of treatment so simple, rapid, and satisfactory, as coating the cord and scrotum with layers of collodion, by the aid of a camel-hair brush previously dipped into it. The sensation is momentarily sharp, the shrinkage rapid, and so is the subsidence of the inflammatory process—facts pointed out some thirty years ago by Bonnafont, but much doubted and almost forgotten. To swollen parts which cannot well be bandaged, collodion is especially applicable for the compression attending its contraction. I was lately consulted in the case of a good-looking boy considerably disfigured by a red and swollen nose, which became very pale and visibly contracted, just after I painted it with successive layers of collodion. I repeated the application three times in the succeeding fortnight, with the effect of producing shrinkage of the organ to its natural size and colour. When the nasal bones are fractured, a very effective mould for keeping them immovable, after adjusting them with the fingers, may be thus made: place over the nose a thin layer of absorbent cotton soaked in collodion; as it dries another layer of cotton and more collodion, taking care that the application extends sufficiently on each side to give buttress-like support. The patient compares the feeling to the application of a firm bandage on the nose, and the bones consolidate effectively under the shield, which may be renewed as it cracks and peels off.

Other cuts than recent ones do well under collodion. A horse-breaker sought my advice for a grazed wound inflicted by a carriage step on the front of his right shin, ten days previously. He had applied water-dressing continuously. The surface of the sore had suppurated, and its edges, for some distance round, were red and tender. I raised the foot, to empty the limb of blood, dried the surface of the sore with absorbent tissue, then brushed it over with collodion, and applied a smoothly compressing bandage over one of my pads. The part was easy at once, and with two more dressings at intervals of four days, cicatrisation was perfect; the patient having continued his business of riding and driving without losing an hour. (*Birmingham Med. Review,* Jan. 1884.)

Uses of Hydrobromic Acid.—Dr. Dana, in a communication to the American Neurological Association (*Phil. Med. Times,* July 14) on the substitution of this acid for the alkaline bromides in insomnia, said that it should be given in larger doses than those usually employed. He had recorded very satisfactory results from drachm doses of the officinal 10 per

cent. solution. It may be substituted in all the milder disorders in which the bromides are used, especially in those requiring vascular and nervous sedatives. In epilepsy some patients had markedly improved under drachm doses four or five times daily, while others had derived no benefit. In chorea and alcoholism it has been used as an adjunct to other treatment. It is a good solvent of quinine, but does not, contrary to the usual belief, prevent cinchonism. Dr. Hammond observed that, after several years' trial, he had abandoned this agent in consequence of its inferiority to the bromides; but he was satisfied that it really does possess the power of preventing the unpleasant nervous effects of quinine. In this last opinion Dr. Eskridge agreed, and he also recommended the use of the acid to relieve insomnia occurring in typhoid conditions. (*Med. Times*, Nov. 24, 1883.)

The Micrococcus of Pneumonia.—Dr. Friedländer lately exhibited before the Berlin Physiological and Medical Societies the specimens of the micrococcus which he has discovered in croupous pneumonia, and reported on the experiments made by him in conjunction with Dr. Frobenius. The micrococci are characterised by the presence of a peculiar mucinous capsule, rendering their recognition easy. Gelatine cultures caused the development of a typical form, and inoculations were made in the lungs of rabbits, dogs, and mice. No result followed the inoculation upon rabbits, but in the dogs occasionally, and in mice invariably, a true lobar croupous pneumonia was excited. Inhalations of the pulverised masses of the organism sometimes gave a like result. A detailed account is given in the *Fortschritte der Medicin* for Nov. 15th, 1883. (*Lancet*, Dec. 1, 1883.)

The Progrès médical of Dec. 8th, 1883, contains the first part of an article upon the pneumonia micrococcus, by E. Bricon, in which the history of the discovery of micro-organisms in this disease is traced, as given in the researches of Billroth, Klebs, Eberth, Koch, Friedländer, Leyden, Günker, and others. The second part will be illustrated by figures. (*Lancet*, Dec. 15, 1883.)

Influence of Iodoform on the Formation of Giant-Cells.—The connective tissue elaborated in morbid conditions, together with fibroblasts and giant-cells, are according to Ziegler developed, not out of Virchow's "granulation-cells," but from epithelioid cells, themselves derived from extravasated leucocytes. Dr. E. Marchand has made a number of experiments on this point and confirms Ziegler's views in part, but differs from him in considering that the epithelioid cells are not developed from leucocytes or white blood-corpuscles with a single nucleus, but from endothelial cells. The giant-cells which are doubtless

developed from epithelioid cells would therefore come to be a product not of white corpuscles, but of endothelial elements such as those of the connective tissue spaces, or of the lymphatics or blood-vessels. The author made experiments by enclosing some carbolised silk in an artificial wound, and also by injecting finely divided silk threads into the jugular vein. Neither of those methods gave satisfactory results, but he was more successful when he introduced pieces of cornea injected with carmine and disinfected with carbolic acid into the body cavity. The giant-cells became developed in those pieces when iodoform was used with the silk thread. In the first series of experiments the formation of giant-cells was not complete until the thirtieth or fortieth day. When no iodoform was used magnified giant-cells could be seen on the tenth or fifteenth day. [*Practitioner*, xxx. 66.] (*Virchow's Archiv*, p. 158, vol. 93.)

Cardiac Remedies.—The following table, on the action of various drugs on the cardiac apparatus, is from the second edition of Professor G. Sée's work, *Diagnostic et Traitement des Maladies du Cœur*:—

Parts acted on.	Excitors.	Paralysers.
Cardiac muscle.	Digitalin. Iodal (small doses). Camphor. Caffein.	Digitalin (second effect), emetin. Copper, barium, and potassium salts. Chloral (in large doses), scillain.
Cardiac motor centres.		Saponin (last effect). Iodal (in large doses).
Cardiac inhibitory centres.	Muscarin.	Atropia. Fabarin. Spartein (large doses). Pilocarpin (secondary effect).
Intra-cardiac plexus of inhibitory fibres of vagus.	Nicotine, } first Pilocarpin, } effect. Calabar bean.	Pilocarpin (secondary effect).
Trunk of vagus.	Aconitin. Nepalin.	Spartein. Nepalin (second phase).
Plexus of accelerating fibres of sympathetic.	Apomorphin.	Spartein.
Inhibitory centres of medulla.	Digitalin.	Chloral. Croton Chloral.
Vaso-motor centre.	Bromide of potassium.	Prussic acid.

Dublin Journ. Med. Science, Oct. 1883.)

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⁎ Any of the foreign works may be procured on application to Messrs. Dulau, of Soho Square, W.C.; Williams and Norgate, of Henrietta Street, Covent Garden, W.C.; or Baillière, of King William Street, Charing Cross.

Department of Public Health.

THE OFFICIAL REPORTS ON THE CHOLERA EPIDEMIC IN EGYPT, 1883.

Reports have now been received by the three Governments, namely the German, French and British, who sent commissioners to Eygpt during the course of last year to make investigations in connexion with the late epidemic of cholera. The several commissioners sent out had very different objects in view, and hence the character of their reports necessarily varies very much. The German reports are only of a provisional character, the Commission having received permission to continue its studies in India, and being now so engaged in Calcutta.

The first document issued was a briet communication which was addressed by Surgeon-General Hunter, the British Commissioner, to Sir Edward Malet on August 6th, 1883, and which only contained some brief account as to the proceedings adopted by the Conseil Supérieur at Cairo, and as to the distribution of the twelve medical officers sent out from England. Next followed Dr. Hunter's preliminary report which was dispatched from Cairo on August 19th, 1883, and which has only just been supplemented by his final and complete report. The first report by Dr. Koch, the chief of the German Commission, was issued from Alexandria on September 19th, 1883; this was followed by a second one dated Suez, November 10th, 1883; and since then a third one has been dispatched from Calcutta on the 16th December. The report of the French Commission, of which Dr. Straus was the chief, was compiled in Paris and issued on the 12th November. We propose in

the present article to give a summary of the matter contained in these several reports, and, as far as possible, to indicate the views which have been expressed by the several Commissions as to the matters with which they have dealt.

I.—Reports of the German Commission.

The German Commission was essentially a scientific one; its work was almost exclusively performed in the laboratory, and was micro-pathological in character. The Commission only reached Egypt when the epidemic was on the decline—a period which is the one least adapted to etiological research. Twelve cholera patients and the bodies of ten persons who had died of cholera were however utilised for the purposes of the inquiry. It is stated that it soon became evident that the blood was quite free from micro-organisms, but that the excreta contained a significant number, and hence the bowel discharges and vomit were mainly used for inoculation purposes. The dissection of the bodies could always be carried out under specially favourable conditions, namely, a few hours after death, and thus before the onset of changes due to decomposition, which as a rule interfere so seriously with microscopic investigations. Not only was the blood found to be free from micro-organisms, but the organs which in other infectious diseases are generally the seat of such organisms were, apart from certain bacteria evidently not connected with the disease, found free from them. On the other hand, the intestines were found to yield important results; for in the case of all recent deaths certain bacteria were found in the coats of the intestines. The bacteria in question are staff-shaped, and belong to the baciili; they resemble the bacilli found in cases of glanders. They had penetrated into the intestinal glands, causing considerable irritation, and in many cases they had made their way behind the glandular epithelium and had there multiplied. The bacilli had also settled in large numbers on the surface of the villi, and had often penetrated their tissue. In the more serious cases these bacilli were in great abundance, and they had passed into the tissues around the glands, making their way into the muscular layer of the intestines. The chief seat of these several changes was found

to be the lower part of the small intestine. In referring to this discovery Dr. Koch states that unless it had been made in connexion with perfectly fresh bodies he could not have attached much importance to it, since the influence of putrefaction is liable to bring about very similar conditions; and it was for this reason that no special value was attached to the discovery of the same bacilli in the case of cholera-infected intestines which he had received from India in the previous year. But in view of the Egyptian experience the former discovery, which was made in the case of four different Indian cholera subjects, becomes of considerable value, and all the more so since the possibility of error in connexion with putrefactive changes can be set aside. And whilst the bacilli in question were met with in all cases of cholera that were immediately brought under the notice of the Commission for investigation, they were absent in cases in which death took place from some other cause after the cholera symptoms had subsided; hence it is inferred that the bacilli must bear some definite relation to the operation of cholera. But the mere finding of bacilli in the mucous membrane of the intestines cannot be regarded as affording proof that they are the cause of cholera, for it could just as well be supposed that the operation of cholera causes such disturbances in the intestinal coats as would enable certain bacteria already present in the intestines to penetrate them. In short, whether the invasion of bacteria, or the operation of the infection is the primary cause, could only be decided by trying to isolate the bacteria from the affected tissues, by propagating them artificially, and then by successfully reproducing disease as the result of inoculation-experiments on the lower animals. Unfortunately such inoculations as had hitherto been possible, and which had been made on rabbits, guinea-pigs, dogs, cats, monkeys, pigs, and rats, had been without effect. Thiersch has made the statement that mice fed upon the contents of a cholera intestine, suffered from diarrhœa; this has been confirmed by Dr. Burdon-Sanderson, F.R.S., but it has been disputed by others. Hence mice were brought from Berlin, and they were inoculated with cholera material. So also were some monkeys, dogs, and poultry; the monkey being an animal susceptible to at least one human disease,

namely small-pox. But once more all the experiments were without result. The bacilli found in the walls and in the contents of the intestines were also artificially propagated, and with these organisms experiments were made by inoculation and by giving them as food; but although certain septic or putrefactive illnesses were produced as the result of the inoculation, actual cholera could not be induced. The Commission express their conviction that there is abundant evidence to show that the infective matter of cholera must often be contained in the intestines in a powerful form, and they are certain that of the samples employed, many must have contained this material; and hence they suggest either that the animals used were themselves insusceptible of cholera, or that the correct method of inoculating has not yet been discovered. But there is another explanation. It is known that cholera outbreaks subside in localities which still contain many susceptible persons, and hence it may be supposed that towards the end of an epidemic the infective matter loses some of its infective power, or that it is at least much more uncertain of spreading than in the earlier stages. If this be the case with human beings who are so specially susceptible as regards the poison, it will in all probability be even more so with regard to the lower animals who, if at all susceptible to its influence, appear to be so only to a limited degree. Whilst therefore the Commission feel that as a mere preliminary investigation the inquiry has been satisfactory, especially in so far as it has led to the discovery of characteristic micro-organisms in connexion with cholera, yet they are convinced that further enquiry must be made, and this under conditions different to those which prevailed at the close of the Egyptian epidemic. They therefore propose in this first report, that the Commission should be directed to continue its work in Bombay, where cholera may be expected to prevail for some considerable time.

The necessary instructions having been obtained to visit Bombay, Dr. Koch, in a second report dated Suez, November 10th 1883, and published in the *Deutscher Reichs-Anzeiger* of December 6th, 1883, states that he has learnt that cholera had, contrary to his anticipations, diminished in Bombay, and hence he asks permission to visit Calcutta. He goes on to say that in connexion with a fresh case of cholera he had found the same

micro-organisms as in the earlier cases, and that he had repeated his inoculation experiments with every modification and care that experience could suggest, but without result. Before leaving Egypt the Commission endeavoured to secure evidence as to whether the epidemic had been the result of importation from India, or whether it had arisen there spontaneously. For this purpose Alexandria and Damietta were specially visited, and Dr. Koch proposes to embody the result of his researches on this head in a separate report.

Another very important question the Commission desired to investigate, namely the effectiveness of quarantine and the probability of the communication of cholera by pilgrims in their journeys to and from Mecca. At this juncture information was received to the effect that cholera had broken out amongst the pilgrims at Mecca, and that orders had in consequence been received to the effect that pilgrims coming from Djeddah should undergo quarantine at Tor. With the aid of the Egyptian Government the Commission visited Tor and El Wedj, and it was hoped that from these places they might have been able to proceed southwards to Djeddah, and there take vessel to India. But quarantine exigences interfered with this scheme, a long detention at Djeddah being required. They therefore returned to Suez, making another inspection of the quarantine camp at Tor, and also visiting the quarantine station at Moses' Wells on the journey. These visits are referred to as having been highly instructive. For, on their first visit to Tor, they had inspected the quarantine camp before its occupation, and immediately afterwards a steamer containing 500 passengers arrived at the port near Tor. The medical officer on board is reported to have declared all passengers to be healthy; but when they were landed several pilgrims were suspected to be suffering from cholera, and they were hence confined in the lazzaretto. On the second visit of the Commission to Tor they found that a second vessel had arrived, that the pilgrims had been landed, and that in both camps cholera had broken out. On the details of this story much depends, and when the special report of the Commission as to this matter is received it will doubtless supply further information on the subject, as also on the general question of the quarantine stations maintained in the Red Sea.

The Commission having had some further experience of quarantine operations by being subjected at Suez to a so-called process of disinfection were allowed to proceed to India.

From Calcutta another report was despatched on the 16th December. The Commission had only arrived there on the 11th, and hence this report contains no additional information as to their labours. It gives some details of their journey; it explains how readily and courteously arrangements were made by the Surgeon-General with the Government of India to enable them to fit up a laboratory, and to carry on their investigations in connexion with the hospital attached to the Medical College; and it then enumerates the objects which the Commission had decided to investigate. These include microscopic work similar to that carried out in Egypt; investigations as to the communication of cholera to the lower animals; cultivation of bacilli for inoculation and other purposes; inquiries as to the influence of soil, water, and air in connexion with the origin and spread of cholera; and lastly, general investigations of the special circumstances attending outbreaks of cholera amongst the various populations, including the troops, prisoners, &c., and of the regulations in force with a view to the prevention of its spread.

[Whilst this article is passing through the press, the text of a further report of the German Commission, dated Calcutta, January 7th, 1884, reaches us. This report confirms Dr. Koch's previous results. The same characteristic bacilli have been found in the case of a regular series of cholera patients and cholera bodies which have been under examination, and the complete absence of these organisms in the case of bodies of persons dying from diseases other than cholera has again been noted. The cholera bacilli have also been cultivated, and their shape and mode of growth in gelatine have been observed. The views of the French Commission, as to a definite organism in the blood, are criticised, Dr. Koch believing that the observers have been entirely misled in this respect.]

II.—Report of the French Commission.

The investigations carried out by the French Commission very much resembled in character those of the German Commission. They consisted essentially of a pathological enquiry directed to the discovery of the cause of cholera. This Commission consisted of Drs. Straus, Roux, Nocard, and the late Dr. Thuillier, who lost his life from cholera during the course of his labours in Egypt. When the Commission reached Egypt the mortality in Alexandria had reached its highest point, but the epidemic had ceased in Cairo. Like their German *confrères,* the French Commission refer to the fact that they were able to make their autopsies on the bodies of patients who had only just died, and that they were thus able to avoid many of the difficulties arising from putrefactive changes. They sought to ascertain whether any special micro-organism was associated with cholera; and to reproduce the disease in the lower animals as the result of inoculations with morbid products, and also with any organism which could be isolated and cultivated for that purpose. In the contents of the intestines the microscope revealed a large number of organisms of different varieties, bacteria of different sizes, and micrococci, isolated or joined together as zooglœa. The material vomited afforded similar results, but no one organism could be identified as special to the disease. Numerous examinations were made of sections of different parts of the intestinal canal, and some account is given of the various micro-organisms discovered. One of the most frequent forms was that of a bacillus, evidently corresponding with the special one described by Dr. Koch, and in a foot-note the Commission consider that this must be the one which the German Commission have sought specially to identify with cholera. But reviewing all the information obtained in connexion with their microscopic observations, the Commission, whilst affirming that no mere post-mortem changes were in question, consider that the mere variety of organisms detected in the sections should of itself raise a strong suspicion that the invasion of the intestine was a secondary matter. The fact that one definite organism was often found in the intestine

in exceptional abundance, in their opinion, only goes to show that it meets, in the intestine of cholera patients, with exceptional opportunities for its propagation. If, they say, there really existed between cholera and this organism, which is found in the intestinal coats, and the cholera disease, the relation of effect and cause, then the organisms ought to be found in the bodies of all cholera patients. This, however, was not the case; for even in three sudden and acute attacks in which the bodies were examined within from ten to twenty hours, no micro-organisms were appreciable in the walls of the intestines, and yet it might have been supposed that these were precisely the cases in which the presence of the special organism would have been most obvious.

An account is next given as to the condition of the blood in the cases of cholera met with, and of certain experiments which appeared to indicate that under special conditions of temperature a certain micro-organism was cultivated in that fluid, the process being most obvious in the lower layers in the tubes used, that is to say, precisely where the action of the external air was least likely to influence the result. But on endeavouring to cultivate this body in various media, such as infusion of fowl or veal, urine, blood-serum from an ox, and even in the blood of rabbits and of cholera patients, no definite result could be obtained. This failure, however, in no way interferes with the belief expressed, that it is in connexion with experiments on the blood that the most is to be hoped for in the future, and that there are strong grounds for believing that the blood of cholera patients is invaded by a definite organism. In this opinion the French Commission are thus at variance with the German one.

Experiments were also made by feeding such animals as chickens, pigeons, quails, a turkey, a jay, rabbits, guinea-pigs, rats, mice, dogs, and cats with cholera vomit and excreta. Pigs also were made on several occasions to eat parts of cholera intestines, as well as cholera discharges, and this after their own intestinal canal had been irritated by a purgative. But neither cholera nor any other disease was induced as the result. In one instance a chicken did die three days after having partaken of rice-water evacuations, and both the contents of its intestines and the post-mortem appearances made the Commission hope

that they had been successful in inducing cholera. But portions of this bird's intestines were eaten by other chickens, and the blood of the affected chicken was used for inoculation purposes without producing any effect whatever. In short, whether the cholera matters were given to young or old animals, whether they were administered fresh or after being kept for several days, and dried either in the air or in carbonic acid, no result was effected. Even the inoculation of large quantities of cholera blood into the veins or into the cellular tissue, was comparatively harmless. The Commission believe that they have cleared away many sources of error and removed difficulties which might have been a hindrance to future observers, but they cannot pretend to have done much towards solving the problem as to the etiology of cholera.

III.—Reports of the British Commissioner.

The reports presented to the Foreign Office by Surgeon-General Hunter (now Sir William Guyer Hunter, M.D.) are three in number. The first was addressed from Cairo on the 6th of August, 1883, and it is a mere preliminary communication. The second was despatched on the 19th of the same month, and though the information then obtained was by no means complete, the contents of the document gave a very clear indication of the views which Dr. Hunter had already formed, and which his later report went to amplify. After giving some description of the foul state of the Nile, of the cemeteries, and of some of the hospitals, Dr. Hunter proceeds to explain that for some time previous to starting on his tour of enquiry in Egypt his thoughts had frequently taken a direction somewhat as follows:—"This country has been visited by five epidemics of cholera since that of 1831, namely, in 1848, 1850, 1855, 1865, and 1883. Diarrhœa is very common and fatal, and conditions for the development and spread of endemic and epidemic disease abound everywhere. What is this disease which is here called 'diarrhœa,' and is so fatal?" With his mind admittedly possessed by thoughts such as these, Dr. Hunter began to make cautious enquiries from medical men and others, and he alleges that as the result he found that cases of "cholerine" were not unknown,

and that they had been seen from time to time by one and another person. A summary of the information which was received from various sources is given, and then Dr. Hunter proceeds, even at that early date, to express what practically becomes the final opinion which he addresses to the Foreign Office. "These facts," he says, "are very significant, and of the first importance. They lead to the conclusion that cholera, be it called by whatever name it may, as Asiatic, epidemic, sporadic, cholera nostras, cholerine, &c., has existed in Egypt for some time past, and that in many instances the diarrhœa, which is so common and deadly, is but a form of cholera."

Some of the information on which he based the view, that the epidemic of cholera instead of being due to importation was only the sudden development of a poison which had existed in Egypt off and on ever since the epidemic of 1865, was included in the August report. A further report was, however, sent in on December 11th, 1883, and adverting to the opinion already expressed, Dr. Hunter proceeds to give further information on the same subject, quoting the opinion of a number of persons, and he then states that the aggregate of the information obtained leads to the conclusion that cholera was endemic in Egypt before the recent outbreak. Very great importance necessarily attaches, under these circumstances, to the character of the evidence which he obtained, and to the sources from whence it was derived, and we propose therefore to refer to this part of the report in some detail.

The first communication on this subject is contained in a letter which Dr. Sierra addressed to Dr. Sonsino in answer to a question from the latter. Dr. Sierra, commences by explaining that he is obliged to trust entirely to memory. He says that in the season of water-melons gastric disorder is very frequent, but that he has not considered this to be cholerine. He however remembers such a case in the person of a Jewess; and he states that he had been told that some cases—never more than two or three a year—had occurred in Alexandria. But he adds that he personally "never saw any cases of sporadic cholera, cholera nostras." He then goes on to give the opinion of certain hospital sisters who believed they had met with choleraic symptoms, but for his own part he does not think

that the existence of cases of cholerine can be a sufficient reason for those who study epidemiology to admit on that account that the present epidemic arose in Egypt. In short, he desires to make it clear that he is not in a position to attempt the solution of the difficult problem in question, not having the necessary knowledge of the places and the opportunity to make the needed investigations.

The next communication is one from Dr. Dutrieux, who visited Damietta about the middle of August, to Chérif Pasha. As the result of this visit he supplies information as to five groups of cases. The first related to two children who, in the preceding April, suffered from "cyanosis," with cold skin and aphonia, but without vomiting or diarrhœa. The next had reference to a child who, early in May, suffered from vomiting, cramp, cold skin, and aphonia, without diarrhœa; this case proved fatal. The third was a single person, who was attacked towards the end of April, and who is stated to have died "of vomiting and diarrhœa." The fourth was an almost similar case. And lastly, a M. Patrino told him that two Greek women were ill for two days early in May of vomiting and diarrhœa, but that they recovered. On this slender evidence as to cases, none of which he had seen himself, Dr. Dutrieux goes on to say:—"I hold that these facts prove that cholera existed at Damietta as early as the end of April;" and he finds it sufficient to enable him to make the following deductions:—"(1) The cholera which became epidemic at Damietta on the 22nd June was not imported thither. (2) Cholera centres existed long before the 22nd June in several places in Lower Egypt. (3) The cholera epidemic raging in Egypt is not Asiatic cholera, but a local cholera."

A further communication from Dr. Sierra follows. It relates two cases of which he got information through the hospital books at Alexandria, and from the hospital sisters. One is the case of an old man, 70 years of age, who suffered from vomiting, diarrhœa, and loss of voice early in June, 1882, but who made a rapid and good recovery. The next was the case of an Italian, who, after eating "a great quantity of beans," was admitted in a cold and collapsed state with no pulse or voice, together with diarrhœa, vomiting, and stoppage of urine. The

case which terminated fatally was regarded as one of "endemic cholera," with probable invagination of the intestine; there was, however, no post-mortem examination.

Dr. Mackie next addresses Dr. Hunter, and he gives four instances of what he calls "choleraic cases;" one in 1872, another in the summer of the next year, and two in 1882; and so far as his memory serves him these are all the cases of the sort that have come under his notice. Dr. Mackie, however, encloses certain information received from others. Thus Dr. Kartulis, writing from Alexandria, gives the case of a young man who, after his return from a shooting expedition, suffered from diarrhœa, vomiting, inability to pass water, and cold perspiration. The stools are stated to have been of a watery, light, rose-coloured appearance, and the vomit of a light-green colour. "The case," adds Dr. Kartulis, "I hold as one of pernicious fever." Dr. Mamlouk also addresses Dr. Mackie. He describes first a very similar case to that of Dr. Kartulis; he speaks of it as "a regular intermittent tertiary fever," and says it occurred some eight years ago. His next and last case occurred some few years since, the patient being a lady who suffered from severe diarrhœa and vomiting, accompanied by loss of voice, algidity, stoppage of urine, abundant perspirations, cyanosis, cramp in the stomach and legs, and burning thirst; the diarrhœa was not however of the 'rice-water' character. Dr. Mackie's next correspondent is Dr. de Castro, who, having had much experience of cholera, in 1866, expresses the opinion that he saw a single case of cholera in Alexandria some six or seven years ago, another about three years ago, a third about two years ago, and a fourth case in September, 1882. He gives no symptoms whatever as regards the first three cases, and of the fourth we learn that there was vomiting, diarrhœa, cramps, and collapse. But says Dr. de Castro, "I looked upon these cases as sporadic, and of but little importance. In view of the circumstances in which they occurred, I was perfectly sure that the disease would not propagate itself"; and he adds significantly in his reference to the late epidemic: "Far otherwise did I consider the first cases at Damietta." He next proceeds to explain that the cases he has enumerated are but instances resembling those which are met with in the great

cities of Europe, but that they differ from Asiatic cholera in that they are less fatal, and that, notwithstanding an absence of all hygienic precautions, they have no tendency to propagate themselves. Dr. Demech in a letter to Dr. Mackie explains that cholera prevailed in the Soudan in 1872, when it reached Korosko (Lower Nubia), but that it did not extend to Egypt. He further adds that every summer he had met with cases of cholera nostras in Alexandria. Dr. Fouquet supplies similar information as to a summer cholera, but he adds that the cases were so different from Asiatic cholera as to make any mistake impossible. Thus far, the cases as to which Surgeon-General Hunter was able to get information from one and another source, went to show that at odd times certain isolated cases of a disease having different names, but very much resembling what is known as sporadic cholera, had occurred in Egypt; several of his informants taking care to explain that they were nothing more than is often met with elsewhere where cholera is never regarded as being endemic, and some distinctly denying that the disease was in any way related to Asiatic cholera.

The next evidence is of a different character. Dr. Haddad, writing from Assiout directly to Dr. Hunter, gives information as to disease which had prevailed in the year 1883 at an earlier date than the outbreak at Damietta, which has generally been regarded as the place at which cholera first made its appearance. Ever since the month of May Dr. Haddad had observed that a profuse diarrhœa was prevalent in Assiout, the evacuations often having been observed to be watery and to exhibit the character of rice-water. The disease was maintained into the month of June, some attacks being associated with cramps, coldness of extremities and blueness of the face ; cases of the latter description at times terminating fatally. About the 20th of June the number of attacks became more frequent, although the disease was not more severe in its type; but it prevailed amongst the people generally and attacked some of the upper classes. This was before the date of any of the cases recorded as occurring at Damietta, and hence the Assiout cases cannot be regarded as having been due to importation from that place. Even in May, out of a total of 120 deaths from all causes, thirty-nine were registered as due to catarrh either of the stomach or the

intestines, to diarrhœa or to dysentery; and in June, out of a total of 116 deaths, thirty-seven were recorded as due to similar affections. This diarrhœal mortality is not high, but in this connexion it is note-worthy that even when later on unmistakable cholera was prevalent in Assiout the proportion of deaths to attacks was very low. Dr. Haddad is convinced that cholera was not imported into Assiout from Lower Egypt in 1883; and regarding the earlier cases recorded as of the same type as the genuine cholera which followed, he says he had no means of ascertaining how long that disease had existed there.

Dr. C. J. Macnally, dealing with the same questions as to the origin of the epidemic at Damietta, quotes some information which unfortunately had to be procured through third parties, who at times were without any medical or scientific training, to the effect that a Dr. Tsamis of Shibin-al-Kom had informed his brother at Zagazig that a large mortality from cholera had prevailed in that place before the Damietta attack, and Dr. Tsamis of Zagazig is reported to have heard of a similar mortality in the villages round that town. Greek merchants too, are quoted who declare that in two villages near Zagazig as many as 200 persons died of diarrhœa and vomiting in January 1883.

A few other communications are appended to Dr. Hunter's report but they are much after the style of those previously adverted to. Thus, Dr. Patterson, of the British Consular Hospital, at Constantinople, having read a previous report of Dr. Hunter's, writes to confirm his statements and to express belief as to the "probable correctness of the inferences" he had drawn. He believes that a form of cholera, by whatever name it may have been designated, has been endemic in Egypt, no year having passed without well-marked cases of "endemic cholera" with rice-water purging, vomiting, cramps, leaden hue of skin, cold clammy perspiration, pinched features, swollen eyes, and the characteristic dark areolæ, husky voice, pronounced collapse, and perfect intelligence, followed in non-fatal cases by reactionary fever. He expresses no opinion of the infective or communicable properties of Asiatic cholera, but, as the result of much experience, he says he has been forced to the conclusion that local conditions of filth, such as have been described in Surgeon-General Hunter's report, do produce a form of disease

so similar in all characters and symptoms to Asiatic cholera as not to be, in practice, distinguished from it. One other letter from Dr. Rabitsch of Cairo enters into details as to a single case very much resembling those that have already been described, and this he regarded as cholera. The case took place in the summer either of 1878 or 1879, but there being no epidemic present Dr. Rabitsch took the opportunity of assuring his assistants that no spread need be anticipated.

This concludes the correspondence which Dr. Hunter brings forward in support of the views which he has expressed. But in the main body of the report he further quotes an official, apparently not a medical man, who is stated to enjoy a high position under the Egyptian Government and who is reported as having said to Sir Evelyn Baring:—"We all know that cholera has been constant here and generally follows the cattle plague, but we are told to say nothing about it." Dr. Hunter then proceeds to sum up this portion of his report by declaring that the evidence referred to satisfactorily proves to him "that cholera has existed in Egypt in an endemic form since the epidemic of 1865, and probably anterior to that period." The epidemic of 1883 "was consequently the outcome of the disease which existed endemically in the country."

In determining the precise meaning which should be put upon Dr. Hunter's conclusion as to cholera being endemic in Egypt, and as to the relation of the genuine cases of the disease which occurred during the epidemic in the summer and autumn of 1883, with the diarrhœal attacks to which the communications he had received refer, some assistance is afforded by a passage in which he expresses his concurrence with Dr. de Castro, where the latter alleges that if the cases which had come under his notice were really cases of cholera, then cholera exists in many of the large cities of Europe. As to this Dr. Hunter says:—"I feel very little doubt that examples of cholera are not of unfrequent occurrence in many of the cities and towns of Europe, not excluding the British Isles." It would thus appear that, according to Dr. Hunter, the cases of English cholera which occur in England every year, and especially in our large centres of population, ought to be regarded as capable of bearing the same relation to cholera, should it appear in our

midst, as was the case as regards the groups of diarrhœal disease in Egypt which preceded the recognised cholera epidemic in that country.

Dr. Hunter next proceeds to discuss the scientific aspect of the question. He does not profess to be a scientific expert himself, and he made no investigations into this part of the subject, preferring to seek support for his views mainly in the well-known reports prepared by Drs. Lewis and Cunningham and addressed to the Sanitary Commissioner with the Government of India. Taking the negative results hitherto obtained by these observers as bringing the information on the subject of micro-organisms in connexion with cholera up to current date, he refers to the French and the German Commission, and then, dealing with the question of the existence of a cholera contagion, he finds himself able to declare emphatically that it "has no existence." As regards the important subject of the origin of cholera in Egypt, the report appears to us to have been prepared under the influence of a very strong antecedent personal bias in favour of the views which it has ended in formulating; views which do not seem to have been at all modified by the very imperfect nature of the only evidence which could be procured, or by the total absence of any scientific experiments. Commenced with a "mind possessed by thoughts" which had been formed "previous to starting" on the tour of enquiry; views already developed did not fail to find sufficient support in evidence of the sort we have quoted. Apart from the information supplied by Dr. Haddad of Assiout, which may be regarded as tending only to show that Damietta was not the first place attacked, the general body of evidence contained in the report does not seem to us to be of a character such as should suffice for the formation of an opinion so entirely at variance with the views of other competent observers who have spent long years in carrying out personal enquiries, and who have endeavoured to avoid forming opinions on hearsay evidence alone. Although we are grateful for every instalment of information and experience on so important a subject as is involved in the matter which has been under discussion, we cannot regard the question—whether cholera has, or has not, been endemic in Egypt—as one which is by any means settled.

THE PRACTITIONER.

APRIL, 1884.

Original Communications.

MICRO-ORGANISMS AND DISEASE.

BY E. KLEIN, M.D., F.R.S.

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(*Continued from* p. 186.)

CHAPTER III.

VESSELS AND INSTRUMENTS USED IN CULTIVATIONS.

All vessels (flasks, test-tubes, beakers, filters, calico), to be used are first thoroughly sterilised by overheating. In the case of flasks and test-tubes, this can be done by exposing them thoroughly in *all parts* to the open flame of a large Fletcher's burner; *while thoroughly heated* the mouth is plugged with a good long plug (1 to 2 inches) of sterile cotton-wool, this being pushed in by means of overheated forceps. The plug in all cases must not be loose, but also not too firm—an error in the latter direction being of course preferable to one in the former. The cotton-wool plug may, if long enough, be single; or, if short ones are used, double. Or the flasks and test-tubes are placed in an air chamber (see Fig. 4) heated by a large Fletcher's burner for several hours, up to between 130° and 150° C. In the case of small flasks and test-tubes this process is of

course much more convenient, since a large number can be heated simultaneously. Beakers and glass filters to be used merely for a temporary operation are placed over a wire net on a tripod and heated by the flame of a Bunsen's burner. In the case of test-tubes which are to receive cultivation-fluids, I

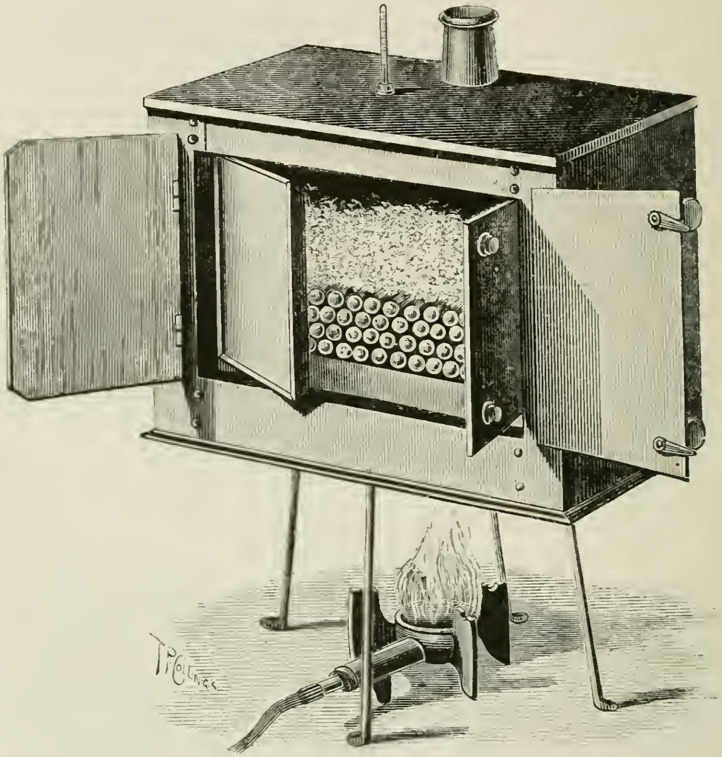


FIG. 4.—HOT-AIR CHAMBER FOR STERILISING TEST-TUBES AND COTTON-WOOL.

An iron chamber with double wall, the inner chamber having separate folding doors. In the inner chamber are placed the test-tubes, glasses, etc., and the cotton-wool, the latter in a loose condition. Both sets of doors are closed, and the apparatus heated by a large Fletcher's burner. A thermometer passing from the inner chamber through the upper wall indicates the temperature of the chamber.

generally expose them, after having been cleaned and dried, in the air-chamber for several hours (three to six) to a temperature of from 130°—150° C.: while hot they are taken out *seriatim*, plugged with the sterile cotton-wool, and replaced in the air-chamber, and heated again for several hours. All this, and other operations to be described below, may appear to some

rather tedious and unnecessarily complicated, but it cannot be too strongly insisted on that in these matters one cannot be too scrupulous. A slight relaxation may, and occasionally is, followed by disastrous consequences in the shape of accidental contamination, and consequent loss of material prepared at the cost of much labour and time. Long experience in these matters has taught me that, although in some instances less scrupulous care has not been followed by bad results, still I have had also many unpleasant failures, owing to slight laxity in these matters.

Several weeks' work may be annihilated by a single omission. Sometimes one is perhaps in a slight hurry, and does not think the want of an additional heating of the test-tube or cotton-wool or an additional boiling of the fluid will be followed by any bad consequences. But, alas, nature does not take into account our convenience, and failure is our reward. If in any kind of experiments "overdoing" is an error in the right direction, it is in these very experiments in the cultivation of micro-organisms.

The *cotton-wool* used for plugging flasks and test-tubes is prepared by pulling up loosely a quantity of good cotton wool and exposing it in a loose state in the air-chamber to a temperature of 130°—150° C. *for several hours, for several successive days.* The cotton-wool ought to be just brown, *i.e.* just singed. Too much charring makes it very brittle, and it is then difficult to make of it a satisfactory plug. The plug used should be not too firm and not too loose: in the former case it is not easy to lift it up quickly, and in the latter it does not close sufficiently well. Cotton-wool that has been kept say only for a day or two in the air-chamber for three or four hours is not absolutely sterile; nor is cotton-wool that has been kept in a compressed state in the air-chamber for any number of days. The central portions remain under these conditions quite white and are not sterile. No cotton-wool that is not just brown, *i.e.* just singed, is safe from risk of impurity. No cotton-wool steeped in absolute alcohol, strong carbolic acid, or any other disinfecting fluid, for ever so many days or weeks, can be absolutely relied on.

As stated above, a plug of sterile cotton-wool tolerably firm, of about one to two inches, or two plugs of about one inch each,

are used for the plugging of the flasks and test-tubes. An assertion such as that made by Dr. Williams at the British Association (Biological Section, September 1883), that cotton-wool plugs are not reliable, because they do not protect the fluids in the vessels plugged with them from accidental air-contamination, is to be accepted only as applying to very loose plugs and to cotton-wool not properly sterilised. To good firm plugs of sterile cotton-wool it evidently cannot apply, since all the results of all workers in this field (Pasteur, Sanderson, Cohn, Koch, Klebs, Buchner, and many others) are against it.

Instruments, such as the ends of needles, and forceps, used in the processes of cultivation, lifting up cotton-wool plugs, making cotton-wool plugs, inoculations, &c., must be heated in the open flame of a Bunsen burner, if they are to be absolutely relied on for cleanliness. Scissors and knives used for cutting tissues which are intended for inoculation, ought to be likewise

Fig. 5.—A Capillary Pipette, Drawn out into Fine Points; Length about 12 to 14 Inches.

scrupulously clean. One ought to keep a special set of instruments, the blades of which are capable of being heated in the open flame without being spoilt.

Syringes used for cutaneous, subcutaneous, or other inoculations ought to be capable of being overheated. The ordinary Pravaz syringe of vulcanite not being capable of undergoing this process, Koch has devised a glass syringe similar to the Pravaz syringe. I do not use any syringe for inoculation, but prefer using each time a fresh *capillary glass pipette* made just before the inoculation. Into this pipette I draw the droplet to be used for inoculation, and having made a very small incision—about $\frac{1}{8}$ of an inch—through the skin, the pointed end of the pipette is pushed forward into the subcutaneous tissue for about half an inch or one inch and then the fluid is blown out into the tissue. In this way I am always absolutely safe from any contamination with a previously used virus, which might possibly adhere to one or other part of a syringe.

The fine point of capillary pipettes (Fig. 5), used for inoculation

of animals, or for drawing out a drop of fluid of a cultivation in a flask or test-tube, or for inoculating material contained in a test-tube or flask, are thus made: while one hand holds the bulb of the pipette, the other holds one end, and putting at some distance from this end the tube into an ordinary flame and quickly drawing it out, a point of extreme fineness can be made. The same is done with the other end. Such a pipette can be considered as practically closed at both ends.

CHAPTER IV.

PREPARATION OF CULTURE-MEDIA FOR INOCULATION.

We have on a former page described the methods to obtain sterile stock of nourishing media suitable for artificial cultivations. The solids, as serum gelatine, serum, and hydrocele fluid, must, before solidification, be placed in test-tubes and small flasks, and then sterilised in the manner above described, to be made ready for establishing cultures, *i.e.* for inoculation. The Agar-Agar mixture however can, like broth, peptone mixture, beef extract solution, and gelatine mixtures, be kept as stock in large flasks. When thus sterile, these latter can be decanted into a number of test-tubes or small flasks, in which the cultivation is to be carried out. Gelatine mixtures (gelatine and broth, gelatine and peptone, gelatine and beef extract) and the Agar-Agar mixture, must of course be liquefied over a flame before being ready for decanting. The test-tubes most suitable are about six inches long, and should not be less than about one inch broad; the flasks are about of the capacity of one to two ounces, and ought to have a neck of comparatively good width. The test-tubes receive the fluids for about one and a half to two and a half inches in depth, the flasks for about one-fourth to one-third of their bulk. All these test-tubes and flasks with their cotton-wool plugs, before receiving the material, should be thoroughly sterilised by overheating. As I mentioned in the previous chapter, this ought to be well borne in mind, for starting with a sterile nourishing fluid—*i.e.* one that has been

kept in the stock flask for several days to several weeks in the incubator at a temperature of from 32°—38° C. and that has remained perfectly clear and limpid—and working with thoroughly sterilised test-tubes and cotton-wool plugs—very little care is required to obtain sterile material ready for inoculation. To start with a stock of nourishing material, however well sterilised, and to decant it into test-tubes with cotton-wool plugs not certainly sterile must lead to failure. I have seen this happen over and over again, and all the material decanted became consequently contaminated and thereby useless for inoculations. The test-tubes and flasks must be well cleaned, then dried, placed in the air-chamber, and kept there exposed for several hours to a temperature of from 130°—150° C. on several successive days, or they may be thoroughly heated in all parts over the open flame of a gas-burner. The same applies to the cotton-wool, as mentioned in a former chapter. The test-tubes and flasks are plugged by means of clean forceps with the cotton-wool, which is just brown, and then replaced in the air-chamber and again heated for several hours on two or three occasions up to a temperature of 130°—150° C., or they may be well heated over the open flame of the burner. To decant sterile stock fluid into these test-tubes and flasks, I proceed thus: A clean beaker with spout, covered with a clean glass plate, is placed on a wire net on a tripod over the flame of a Bunsen burner, and thoroughly heated for half an hour or so; then it is allowed to cool, and when cool, the plug of the stock flask is lifted with forceps, and some of the sterile fluid quickly poured from the flask into the beaker. The plug is replaced in the neck of the stock flask and the beaker covered with the glass plate. Of course the quantity poured into the beaker should be large enough to supply the required number of test-tubes or small flasks. The stock flask containing still some fluid, having been opened for however short a time, has of course been exposed to air-contamination, and therefore must be treated accordingly, if the fluid left in it is to serve as sterile nourishing material on a future occasion. Consequently it is subjected to boiling for from fifteen to thirty minutes, then placed in the incubator, boiled again the next day and put back in the incubator, where it is left at a temperature from 32°—38° C. for

several days. If after a week or so the fluid remains limpid, it is of course to be considered sterile.

Next, the fluid that has been poured into the beaker (covered with the glass plate) is poured as quickly as possible into the test-tubes, one after the other, by lifting with clean forceps the plug and pouring in the fluid to a depth of one and a half to two and a half inches, and the plug replaced.

During this procedure contamination with air-organisms, if there be any about, becomes inevitable. To lessen this chance as much as possible, it is necessary to lift the plug with clean forceps, to pour the fluid as rapidly as is practicable into the

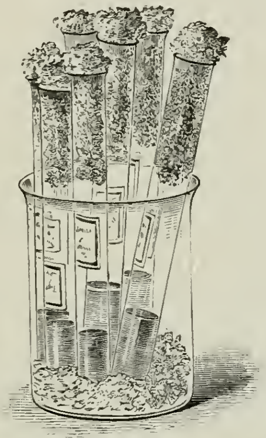


Fig. 6.—A Beaker Containing a Number of Culture-tubes Plugged with Cotton-wool.

test-tube or flask, and to replace immediately the cotton-wool plug. Further it is necessary to bear in mind, that the atmosphere is not at all times and everywhere equally contaminated (see Prof. Tyndall's observations). I generally avoid undertaking this process on windy days, and when I do it, I generally close windows and doors and keep the air in the room as still as possible. I do not do it in a room in which recently (say an hour or two previously) the floor, walls, or tables have been swept.

I have opened under these conditions the plugs of test-tubes containing sterile material, and kept them so for a time varying from one to ten seconds, and in some instances I have not seen more than from 10 to 20 per cent. contaminated.

Now, having filled the required number of test-tubes and flasks with the desired quantity of fluid, I subject these *seriatim* to boiling. By means of an ordinary test-tube holder I hold them above a very small flame until the fluid boils, and keep it so boiling for from two to five minutes. During this process of boiling the cotton-wool is only slightly pulled up, and immediately before ceasing to boil the plug is again replaced, and pushed down with a clean glass rod. Then the test-tube is placed (of course upright) in a beaker at the bottom of which a layer of cotton-wool—a sort of cushion—has been placed. When finished, the test-tubes in the beaker are all transferred to the incubator and kept here for from twelve to twenty-four hours at a temperature of 32°—38° C. Then the boiling is repeated once more. After this they are kept in the incubator for several days to several weeks. I generally keep them there for two to three weeks, and all those in which the fluid has remained limpid and clear are considered sterile and ready for use. As a rule, starting with sterile stock fluid, and using thoroughly sterile test-tubes and cotton-wool plugs, after once or twice boiling after decanting, there ought to be no loss of tubes through accidental contamination with air-organisms (during decanting). Sometimes, however, I have had loss to the amount of 5 per cent. or more, but then there was always a hitch of some kind traceable. To decant under carbolic acid spray is not practicable and possesses many unpleasant drawbacks, besides in some instances when I used it, there was really a greater percentage of contaminated tubes than without it. I therefore do not use the spray.

Test-tubes containing solid nourishing material are generally kept sufficiently inclined during solidification of the material (see a former chapter) to allow the material to spread into a layer of large area, although this is not essential.

CHAPTER V.

METHODS OF INOCULATION.

HAVING now in test-tubes and small flasks sterile material ready for inoculation, it is necessary to describe the mode of inoculating the same.

1. *Inoculations from Artificial Cultures.*—The first and simplest is the case where it is required to inoculate a new tube or flask with a definite organism that has been growing previously in a culture-tube; that is to say, where it is required to establish from an artificial cultivation a new and further artificial cultivation. Take a freshly drawn-out capillary pipette, with a fine point, as described in a former chapter; draw up with clean forceps slightly the top part of the cotton-wool plug of the old tube or flask, push carefully and gently one of the pointed ends of the capillary pipette—the other can be broken off blunt—through the remaining part of the cotton-wool plug, and push it downwards till it emerges into the culture-fluid, or, if this be solid material, till it reaches the spot or place where the organism is growing; allow a small droplet to ascend into the capillary pipette, which it readily does by capillarity, or, if a larger quantity is required, draw it up by gently sucking at the outer end of the capillary pipette. Then draw the capillary pipette altogether out of the tube and cotton-wool plug, and push this latter down with the forceps into its former position. Immediately after this proceed to inoculate the new culture-tube by doing exactly the same as before, viz., draw up slightly with the forceps the top part of its cotton-wool plug, push through the remainder of this plug the pointed end of the capillary pipette, *i.e.* the one containing the droplet of the material to be sown, and push it into the material at the bottom of the test-tube or flask. A trace of the sowing material flows out by itself, or, if a large quantity is required, it is carefully blown from the pipette. If the sowing is to be carried out on the surface of the solid nourishing material, the inoculation is of course performed by depositing

the seed on the surface; if in the depth, the end of the pipette is pushed down into the depth of the material and the seed there deposited. The pipette is then altogether withdrawn and the plug replaced as before. The new tube is then placed in a beaker on a cushion of cotton-wool, and exposed to the required temperature in the incubator.

If we have, however, a culture-fluid or any fluid that contains, as the microscopical examination proves, various species of organisms, which we wish to isolate, *i.e.*, if we wish to introduce into a new culture-tube only one species, then the method of Klebs of "fractional cultivation," or the method of Lister and v. Nägeli of "dilution," is resorted to.

The "fractional cultivation" consists in the attempt to isolate by successive cultivations the different organisms that have been growing previously in the same culture. If we take up by means of a capillary pipette a trace of the culture-fluid, and inoculate with traces of it in the manner above described a series of new culture-tubes containing various nourishing materials, and expose these tubes in the incubator to a definite temperature, say 35° C., then the chances are that in the first twenty-four or thirty-six hours not all the different species of organisms sown out will have increased equally in numbers in all tubes; most probably only one species in each tube, *i.e.*, the one that grows best in this particular medium and at this particular temperature, will be found to have increased to an enormous extent, while the others have made little or no progress as yet. The nourishing fluid appears turbid, and filled chiefly with the one kind of organism. Now draw out with a fresh capillary pipette a minute droplet of this new culture and inoculate with a trace of it a new culture-tube. The chances are that you inoculate only one kind, that is, the one which is most abundant or perhaps is solely present. After twenty-four hours' incubation this new tube contains now probably only one kind of organism. To make it quite certain, inoculate from this a new culture-tube in the same manner, and now you probably have sown only a single species. In this manner by continued transference it is possible to obtain cultures with only one species of organisms. Many conditions, such as naked-eye appearances of a particular kind, coloration of the culture-medium, forma-

tion of a pellicle, the quantity of growth in a given time, soon indicate whether we have the desired single species; in some instances it is, however, extremely difficult to isolate after this method.

The method of "dilution" means diluting the culture-fluid containing the various species to a very large extent with some sterile indifferent fluid, such as well-boiled saline solution of 0·6 per cent., and then inoculating new tubes with a droplet of this greatly diluted material. For this purpose draw into a rather large pipette a tiny droplet of the old culture-fluid, then pass the pointed end of this pipette into a test-tube or flask (plugged) containing well-boiled saline solution, and draw up a quantity of this solution so as to greatly dilute (1000-fold or more) the droplet of culture-fluid, and with this inoculate then a series of new culture-tubes containing different nourishing material, using always only a trace for inoculation. In this way it is probable that, owing to the great dilution, the trace of a droplet of this mixture used for the new inoculation contains only one species. Using a series of new culture-tubes and inoculating them thus, after twenty-four hours of incubation, it will be found that some tubes have not received any seed, others only one species. If it be required to dilute the original fluid greatly, say if it teems with different organisms, then a droplet of this is placed into a large flask containing the well-boiled saline solution, so that a dilution of 1 in 1,000,000 or more can be effected.

The two methods, *i.e.* that of fractional culture and of dilution, may be successfully combined in this way: from the first or second new culture, established after the method of fractional cultivation, in which, after twenty-four or thirty-six hours, one species greatly predominates, draw out with a large capillary pipette a droplet, and dilute this to a great extent with the saline solution, as described above, and now inoculate with a trace of this mixture a new culture-tube. Or, if after twenty-four hours' incubation the microscope reveals in this further culture more than one species, continue the process of dilution and inoculation for a further generation. Thus it is possible to obtain cultures of only one species, although the original fluid contained several species of organisms.

2. *Inoculations with Blood, Juices, and Tissues.*—To establish a cultivation from blood of a dead animal, cut open the thorax by removing the sternum with clean scissors, cut open the pericardial sac, pierce with the pointed end of a fresh capillary pipette the wall of the right ventricle or right auricle, and allow a drop or two of blood to ascend into the pipette, or if a larger quantity is required suck it up. Withdraw the pipette and inoculate new culture-tubes as above. Or, if blood of a large vein is required, separate the vessel with clean instruments, and make a small incision with clean scissors and push the pointed end of the capillary pipette well forward. If juice of a lymphatic gland, or spleen, or other parenchymatous organ be required, pierce the organ, after having washed its surface with solution of perchloride of mercury (Koch), with the pointed end of a capillary pipette, then push it into the part required for a little distance, and squeezing the organ press a drop or two of the juice into it. The same procedure is adopted when the pus of an abscess is required, the wall of which can be pierced with the pointed end of the capillary pipette. If not, a slight incision is made and the pipette introduced through this into the abscess. If blood of a living animal is required, expose a vessel with clean instruments, make a small incision with clean scissors, push through this incision the pointed end of the capillary pipette well forward, and allow the blood to rise into the capillary tube. If blood of a living human being is required, clean well with soap and water and then with strong carbolic acid or perchloride of mercury solution the tip of a finger, make a venous congestion in the last phalanx by compressing it with a corner of a handkerchief, prick the volar skin of the phalanx with a clean (overheated and cooled) needle, and plunging the pointed end of the pipette into the drop of blood allow a droplet to ascend into the capillary tube of the pipette.

If solid tissues or parts of tissues are required, *e.g.* the base of an ulcer, a tubercle of the liver, spleen, or lung, it is possible to squeeze into the capillary tube of a pipette, after pushing its pointed end into the part, a small droplet of juice of the part required; but if this be not practicable, *i.e.* if a solid particle be required, then follow Koch's method. This is as follows: cut with clean scissors or scalpel into the part, dig out rapidly with

the point of a needle or platinum wire previously overheated in the flame of a burner a small particle, and quickly introduce this into the culture-tube to the place required, *e.g.* surface or depth of a solid or fluid nourishing material. Of course in this case the cotton-wool must be altogether lifted, and therefore contamination with organisms is possible. But inoculating several tubes at once and performing the operation quickly, one always succeeds in getting some of the tubes without any air-contamination. I have made numerous inoculations with solid particles (tubercles) in this manner, and like Koch have seen only a small percentage of tubes going bad through contamination with air-organisms.

The same plan, *i.e.* of using the clean point of a needle or platinum wire for taking up the material to be used for inoculation, is resorted to if one has to deal with a culture of solid nourishing material, on or in which the organisms are growing that we want to transplant either for inoculation of a new tube or of an animal. A useful method, which does not require the lifting out of the plug at all, and which can easily be employed in the last case is this: deposit from the pointed end of a capillary pipette a droplet of some sterile fluid (broth or thoroughly boiled saline solution) on the spot of the solid medium on which the organisms are growing, then scratch this spot with the end of the capillary pipette in order to get the organisms off from the solid basis and mixed with the drop of fluid deposited there, then let this drop again ascend into the end of the capillary pipette, and withdraw this altogether. All this can be done without lifting out the cotton-wool plug of the test-tube or flask in which the growth is proceeding.

If one has to use a particle of tissue the surrounding portions of which are probably contaminated by putrefactive organisms, *e.g.* a tubercle in the lung or a tubercle in the spleen, it is well to follow Koch, and to disinfect the surrounding parts by just washing them with a dilute solution of corrosive sublimate, and then to remove these parts with clean scissors so as to obtain the central particle which one wishes to use for inoculation: of course one must not steep the whole organ in sublimate solution, since this would naturally destroy all organisms.

All these methods can be easily modified according to the

requirements of the special cases, and it is not necessary here to give more than what has already been described in the preceding.[1]

In order to observe in a microscopic specimen the gradual changes in the growth of a micro-organism, there are several methods employed. In all of them it is of course necessary to keep the specimen heated up to the desired temperature.

The simplest method consists in sowing the organisms on a suitable nourishing material in a small glass cell, fit to be placed on the stage of a microscope and to be there observed even with high powers, similar to those cells which Koch has used in his studies on bacillus anthracis. Such a glass cell consists of a glass slide, in its centre a concave pit, not too large, and capable of being quite closed up by an ordinary cover-glass, the edges of which fasten by means of clean paraffin or olive oil. Place with a clean needle a speck of spleen pulp of an animal dead of anthrax into a drop of nourishing material, fluid or solid, on the centre of a clean cover-glass, the edges of which have been prepared as just mentioned, and fasten this on the above slide so that the specimen faces the concave pit; expose this so prepared specimen to a constant temperature, either by placing it in the incubator and examining it with the microscope from hour to hour, or on the warm stage (Stricker, Ranvier) used in histological work for directly observing the influence of temperature on the various cells and tissues; or, place it simply on the stage of the microscope and expose the whole (*i.e.* microscope and all) in a suitable warm chamber (after Klebs), but so that the chamber allows light to pass by means of a small window to the mirror of the microscope, while the eyepiece is so arranged as to project through a hole in the upper wall of the chamber. The plan which I generally follow is with slight modifications that of Koch.

A glass cell (Fig. 7) is made by cementing a glass ring, $\frac{3}{4}$—$\frac{7}{8}$ inch in diameter and about $\frac{1}{8}$—$\frac{1}{12}$ inch. high, on to an ordinary glass slip. The chamber of this cell is well cleaned with absolute alcohol. A thin cover-glass, square or round,

[1] Compare also Koch, *Untersuchungen über pathogene Bacterien*, in *Berichte aus dem k. Gesundheitsamte*, Berlin, 1881; and *Die Aetiologie d. Tuberculose*, *Berlin. klin. Wochenschrift*, No. 15, 1882.

about one inch in breadth, is well heated by holding it for a few seconds over the flame of a gas burner or spirit lamp. On the upper edge of the above glass ring is placed with a camels' hair brush a thin layer of clean olive oil; a droplet of water is deposited on the bottom of the cell in order to keep this afterwards well supplied with moisture; a drop of the sterile nourishing material (broth, aqueous humour, hydrocele fluid, blood serum, liquefied gelatine mixture, liquefied Agar-Agar mixture, etc.) is then deposited by means of a capillary pipette on to the centre of the cover-glass; then the point of a capillary pipette or needle containing the material it is desired to sow is rapidly plunged into the drop of the nourishing material (or if this is solidified is deposited in lines or points on

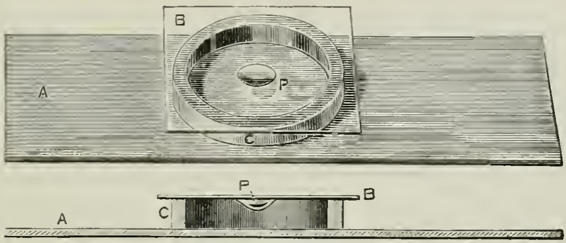


Fig. 7.—A Glass Cell, for Observing under the Microscope the Progress of Growth of Micro-organisms.

The upper figure shows the cell in perspective; the lower figure in profile or cross section.
A. Glass slide.
B. Cover-glass.
C. Glass ring forming the wall of the chamber.
P. Drop of nourishing material in which the micro-organisms grow.

the drop of nourishing material), the cover-glass inverted and placed on to the glass ring: the layer of olive oil keeps the edges of the cover-glass air-tight on the glass ring. This cell is then placed into the incubator and exposed there to the desired temperature. Microscopic examination is carried out from time to time to watch the progress made. This can be done with high powers, since the growth is taking place on the lower surface of the cover-glass.

Although contamination with air-organisms is not excluded, still it is possible by making several specimens at the same time and operating rapidly, to obtain pure cultures. This glass cell can be also watched on a warm stage, or in a Klebs' warm chamber.

M. Nachet of Paris has designed a glass cell, in which the drop of nourishing material is deposited on to the bottom of the cell, the glass slip being here replaced by a very thin glass; but then there is a peculiar arrangement in the microscope, by which the lower surface of the glass cell, *i.e.* the one nearest to the growth, is directly subjected to microscopic observation.

After what has been said above about inoculation of solid and fluid nourishing media with solid matter, it is not necessary to dwell specially on the method of inoculations with earth or similar substances.

3. *Examination of Water for Micro-organisms.*—Most water contains bacteria of some kind, as has been shown by direct experiment by Burdon Sanderson.[1] If any sample of water is to be examined for micro-organisms, particularly bacterial forms, it is allowed to stand for a few hours, till most of the particulate matter is settled, and then with a capillary pipette a little of the fluid and sediment is drawn out and used for (*a*) microscopic specimens to be examined fresh; (*b*) microscopic specimens prepared after the Weigert-Koch method, *i.e.*, by spreading out on a cover-glass a thin layer, drying it, staining it with suitable aniline dyes, *e.g.* Spiller's purple, gentian violet, methyl blue, or magenta, washing with water, then spirit, then distilled water, then drying, and finally mounting it in Canada-balsam solution. (*c*) Test-tubes containing sterile nourishing material (broth, Agar-Agar mixture, gelatine mixture, Cohn's or Pasteur's fluid) are inoculated in the manner described previously, *i.e.* by piercing the cotton-wool plug with the pointed end of the capillary pipette. These test-tubes are then exposed in the incubator, and after one or two days or more, a sample is withdrawn with a capillary pipette, and used for microscopic examination. As a rule, after a day or two of incubation we can already distinguish with the unaided eye whether there are any organisms present, the nourishing fluid either being uniformly turbid —this is generally the case—or there being a growth at the bottom of the fluid. But of course the microscopic examination only shows what kind of organisms are present. New cultivations are made from this one, if any are required. (*d*) A good

[1] *Reports of the Medical Officer of the Privy Council*, 1870.

plan of recognising easily that there are present various kinds of organisms in such cultures is one similar to that recommended by Professor Angus Smith.[1] Sterile gelatine broth or gelatine only contained in sterile test-tubes plugged with sterile cotton-wool is liquefied, but of course not heated to more than about 35°—40° C., then inoculated with the water (to be tested), by means of the capillary pipette; after inoculation the gelatine is mixed by shaking the test-tube slightly. In this way the organisms present in the water are distributed in the gelatine. Then the gelatine is allowed to set and is kept in this solid state. The organisms being distributed in the gelatine, after some days' growth are noticeable as clusters which gradually increase in extent and are distributed in various parts of the medium. The various species, owing to difference of growth, form clusters differing in aspect, size, and arrangement.

4. *Examination of Air.*—The simplest plan to test for the presence of organisms in the air is to draw out the cotton-wool plug of several test-tubes or flasks containing the sterile nourishing material, or if this be boiled potato, paste, &c., to expose their surface, and to leave it thus for variable periods, from a few seconds to several minutes. Then replace everything and expose the material to incubation, or keep it only at the ordinary temperature of the room. Another method is to collect the particles present in the air on glasses moistened with pure glycerine, and then to make microscopic specimens or inoculate tubes with this glycerine.

A method which is very useful is the one recommended by Cohn and Miflet.[2] The principle of it is, that by means of an aspirator, an air-pump of any kind, *e.g.* a Sprengel pump, or simply the fall of water, air of a particular locality is drawn into one, two, or more Wolff's bottles (each with the ordinary two bent glass tubes), connected with one another by short pieces of india-rubber tubing, and containing the sterile material in which the organisms are required to grow. All bottles and tubes being of course sterile, the plugging of the tubes after the air has passed is done with sterile cotton-wool. Any quantity of air for any length of time can thus be passed through

[1] *Sanitary Review*, 1883.
[2] *Zeitschr. f. Biol. d. Pfl.* iii. 1, p. 119.

a series of such bottles, the one that receives the air first being of course most contaminated.

The bottles are after the experiment placed in the incubator if required, the outer end of their tubes being plugged with cotton-wool.

Miquel[1] has carefully described many ingenious methods for the study of air-organisms.

CHAPTER VI.

MORPHOLOGY OF BACTERIA.

BACTERIA are minute organisms not containing chlorophyll, and multiplying by fission—hence the term *schizomycetes* (v. Nägeli). They are composed of a kind of protoplasm, the mycoprotein of Nencki, and are invested with a membrane, which is composed chiefly of cellulose and a certain amount of mycoprotein (Nencki).

Their contents are transparent and clear, but sometimes contain minute bright granules of sulphur (Beggiatoa). Owing to the cellulose membrane they resist the action of acids and alkalies. Many species of bacteria—micrococcus, bacterium, spirillum—are able by rapid multiplication to form colonies; the individuals are then embedded in a hyaline gelatinous matrix produced by them, this is also mycoprotein. Some species are possessed of one or two straight or slightly spiral cilia or flagella, and thereby they are capable of locomotion, darting through, or spinning round, in the fluid in which they are suspended. Such is the case with many kinds of bacteria, bacilli, and spirilla.

Bacteria grow best when left undisturbed; movement of the vessel in which they grow is not advantageous. Light and electricity do not appear to have a decided influence, since most of them grow well in the light. According to Cohn and Mendelssohn,[2] strong electric currents have a noxious influence on the growth of micrococci.

Some bacteria require free access of oxygen, and are called

[1] *Les Organismes vivants de l'Atmosphère.* Paris, 1883.
[2] Cohn's *Beitr. z. Biol. d. Pfl.* Bd. iii. 1.

aërobic (Pasteur); others grow without free oxygen, and are anaërobic (Pasteur). All require for their growth certain nourishing materials containing carbon and nitrogen. Water is an essential element for them, and a certain temperature is in many instances a stimulant of their growth. Most pathogenic bacteria require for their propagation a temperature varying in the different cases between 18° and 40° C. The bacteria obtain their nitrogen from organic compounds; some are capable of obtaining it from compounds as simple as ammonium tartrate; others, especially pathogenic organisms, require much more complex combinations, such as occur in the animal body. Carbon they obtain likewise from organic compounds, such as carbohydrates, amongst which sugar is the chief, and vegetable acids combined as salts are also to be mentioned. It is essential for all that certain inorganic salts, phosphates, potassium and sodium salts, should be present, since their own substance contains a large percentage of it—4 to 6 per cent.

While all are capable of disintegrating organic combinations containing nitrogen, they in their turn help to produce certain chemical products, which in some cases are definite for a definite species (see below). Such is the case with the various bacteria connected with the fermentations producing lactic acid, butyric acid, and acids belonging to the aromatic series. On many bacteria connected with putrefaction, and also on some pathogenic organisms, these chemical products have a deleterious effect. Small quantities impede their growth, and sufficiently large quantities kill them altogether.

Most bacteria are killed by heat below the temperature of boiling water, many of them when exposed for several hours to a temperature above 50°—60° C. Exceptions are the spores of bacilli, which in some instances (spores of hay bacillus, Cohn) require exposure to the heat of boiling water for as much as half an hour. By raising the boiling point above 100°, it does not require more than a few minutes to kill them (Sanderson).

Drying destroys most bacteria, except the spores of bacilli. Freezing destroys likewise most bacteria, except the spores of bacilli, which survive exposure to as low a temperature as – 15° C., even when exposed for an hour or more. No spores survive exposure to a temperature of 120° C.

Amongst those substances which inhibit the growth of, or altogether destroy the bacteria, are carbolic acid, salicylic acid, thymol, &c.; corrosive sublimate is the most powerful (Koch), since even solutions as weak as 1 : 300,000 are said to inhibit the growth of bacillus anthracis.

The best classification of bacteria is that given by Cohn,[1] and this we shall adopt: (1) spherobacteria or micrococci; (2) bacteria or microbacteria; (3) bacilli or desmobacteria; (4) spirilla, (5) spirochætæ. There are also various kinds which approach one or the other of these, *e.g.* ascococcus, sarcina, leptothrix (Beggiotoa), cladothrix, streptothrix, &c. (see below).

I shall not attempt to give an exhaustive description of the morphological characters of all micro-organisms, but shall limit myself to those forms which are related in some way or other to diseases.

CHAPTER VII.

MICROCOCCUS (Hallier, Cohn).

By the specific term micrococcus is understood a minute spherical or slightly oval organism (spherobacterium, Cohn), that like other bacteria divides by fission (schizomycetes), and that does not possess any special organ, cilium or flagellum, by using which it would be capable of moving freely about. Micrococci, like other granules when suspended in a fluid medium, show (Brownian) molecular movement. Micrococci propagate always by simple division, never by any other means, *e.g.* germination and spores. All assertions to the contrary are based on incorrect observations. All micrococci possess a delicate membrane of cellulose, and owing to this resist the action of alkalies and acids. The contents are homogeneous and highly refractive while active, pale when inactive. They consist like those of other bacteria of mycoprotein (Nencki). The size of micrococci varies within considerable limits, say 0·0008—0·002 millimetres, or even a little more. Micrococci vary greatly as regards both size and mode of growth. All multiply by slightly elongating and then dividing by a transverse constriction into two: a dumb-bell; each of these again divides into two, either

[1] *Beitr. z. B. d. Pfl.* Bd. i.

transversely or in the same direction as before. The new elements of successive divisions may remain connected, and thus form a chain (or mycothrix, Itzigsohn and Hallier; toruliform string, Cohn), or they separate into single organisms or dumb-bells. In some species there is a pre-eminent tendency to form

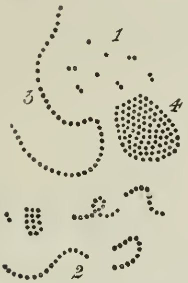


FIG. 8.—MICROCOCCI OF PUTRID HUMAN SPUTUM.

1. Single micrococci and dumb-bells.
2. Short chains.
3. A long chain.
4. A zooglœa.

This and all subsequent figures are drawn under a magnifying power of about 700 diameters except stated otherwise.

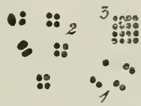


FIG. 9.—FROM THE SAME PUTRID SPUTUM AS IN PREVIOUS FIGURE. THE MICROCOCCI ARE LARGER.

1. Dumb-bells.
2. Sarcinæ.
3. A small zooglœa, in reality consisting of four sarcina-groups.

chiefly dumb-bells, in others to form shorter or longer chains generally more or less curved.

Such exquisite chains one meets with sometimes in serum of blood exposed to the air for some days, and in pleural and peritoneal exudations of animals dead for a few days. I have seen in an artificial culture made by my friend Mr. A. Lingard

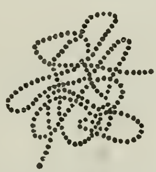


FIG. 10.—PART OF A CONVOLUTION OF CHAINS OF MICROCOCCI; FROM AN ARTIFICIAL CULTIVATION STARTED WITH THE SERUM OF A BLISTER OF A RABBIT'S EAR.

from a blister in a rabbit's ear the most exquisite convolutions of threads of micrococci. (See Fig. 10.)

A dumb-bell is also called a diplococcus (Billroth). Between the individuals of a dumb-bell there is always noticeable a short pale intervening bridge.

Some species are specially characterised by dividing into a

dumb-bell, and each of the elements dividing again transversely into a dumb-bell; a group of four (tetrade or sarcina-form) is thereby produced. Some species are occasionally met with, particularly in products of air-contamination, in which the four individuals are closely pressed against one another, and then each assumes more or less the shape of a cube, a true sarcina (see below). But each of these cubes divides into four small micrococci arranged as a small sarcina, so that a sarcina-within-sarcina-form results.

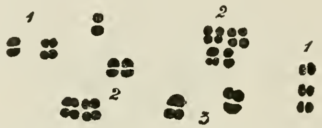


FIG. 11.—GIANT MICROCOCCI, FROM SAME PUTRID SPUTUM AS IN PREVIOUS FIGURES.

1. Dumb-bells.
2. Division of dumb-bells into sarcina.
3. Incomplete division into sarcina.

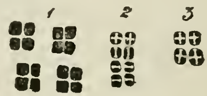


FIG. 12.—SARCINA-MICROCOCCUS FROM AN ARTIFICIAL CULTIVATION.

1. The elements of each sarcina-group of four appears single.
2. The elements incompletely divided into secondary groups.
3. Each element of the previous groups has divided into four small micrococci.

In many instances the individual members resulting from division remain closely adherent, without any definite arrangement, and thus form smaller or larger continuous masses, *zooglœa* or colonies, in which the individuals appear embedded in a hyaline gelatinous matrix, the amount of this varies in the different species; in some there is little of the matrix actually visible, the micrococci being in close juxtaposition, in others it is easily recognised, the interstices between the individuals being measurable.

In some of the pigmented species (see below) the interstitial matrix contains the pigment. Zooglœa masses always present themselves as uniformly granular, the granules or micrococci being of the same size.

True micrococci never elongate to form rods, although in certain rod-like bacteria, the individual elements sometimes assume the shape of spherical elements (see below).

Some species of micrococci form after some days a pellicle on the surface of the nourishing material, although there is also an abundance of these micrococci in the depth of the nourishing material. This pellicle is composed of zooglœa, and after some time bits of it, or the whole, sink to the bottom if the medium

is fluid. Micrococci that thus form pellicles are pre-eminently aërobic (Pasteur), *i.e.* require a great deal of free oxygen, which they receive from the air to which they are exposed on the surface of the nourishing material. Other species do not require free oxygen (anaërobic, Pasteur), and therefore grow well in the depth and do not form a superficial pellicle. There is a marked distinction in this respect between different species. The micrococci occurring in connexion with disease are anaërobic.

When cultivated in the incubator in suitable fluid nourishing material, they produce after a day or two general turbidity.

Micrococci may be divided, according to their chemical and physiological function, into: (*a*) septic, (*b*) zymogenic, (*c*) chromogenic, and (*d*) pathogenic micrococci.

(*a*) The *septic micrococci* are micrococci that occur with other septic bacteria, wherever there is decomposition of organic matter in solids or in fluids. There exists a large number of species of such micrococci, differing from one another in size and mode of growth. They are widely distributed in the air, and contamination by air is often followed by the appearance of micrococci. They also occur in the body of man and animals wherever there is dead tissue, in which they grow well and copiously. Of this kind are the micrococci found in ordinary pus (Ogston), in the normal oral cavity (on the filiform papillæ of the tongue and on the mucous membrane), in the bronchial secretion in ordinary catarrhal exudations (nasal cavity, bronchi, &c.), and on the free surface of intestinal and other ulcerations.

(*b*) *Zymogenic micrococci* are micrococci associated with definite chemical processes. (*a*) Micrococcus ureæ, causing the ammoniacal fermentation of urine (aërobic, Pasteur), occurs singly, as dumb-bells or chains, and as zooglœa. (β) The micrococcus of the mucoid wine fermentation produces (Pasteur) a peculiar mucoid change in wine and beer, and occurs chiefly in chains. (γ) The micrococcus causing phosphorescence in putrid meat and fish (Pflüger) forms chiefly zooglœa (aërobic).

(*c*) *Chromogenic micrococci* (Schröter, Cohn). These micrococci are characterised by their power of forming pigment of

various colours. They grow well at ordinary temperatures, and occur chiefly as zooglœa; they differ from one another by forming different pigments. The thicker the layer the more marked is the pigment. This is either soluble in water or it is insoluble, and therefore remains limited to the cells and their interstitial substance. The cells are spherical (Micrococcus prodigiosus, chlorinus, fulvus) or slightly elliptical (M. luteus, auriantiacus, cyaneus, violaceus). They are all aërobic and produce this pigment only when there is free access of air. They

FIG. 13.—OVAL MICROCOCCI WHICH POSSESS A BLUE COLOUR, MICROCOCCUS CYANEUS, SINGLY AND IN DUMB-BELLS.

grow best on boiled potato, bread, paste, and boiled egg albumen. They can be transplanted, and always produce the same pigment. When growing and kept in the depth of a solid nourishing material, *i.e.* removed from the free surface, they grow as colourless micrococci. They abound in the air—in some localities and at certain seasons more than at others. (α) Micrococcus prodigiosus is blood-red, the colour is lodged not in the micrococci but in the interstitial substance, and is insoluble in water, soluble in alcohol; it occurs chiefly as zooglœa, in the shape of smaller or larger droplets. The cells are the smallest of all pigment-micrococci. (β) Micrococcus luteus is yellowish, and the pigment is insoluble in water. It occurs also in fluid nourishing material, forming a pellicle. I have met with it in the air, and have sown it in fluid pork broth, where it grew very abundantly at a temperature of 32°—38° C. It was found as single cells or dumb-bells, and formed a thick pellicle on the surface, which after some time sank down into the fluid, the pellicle retaining a pale yellow colour. (γ) Micrococcus auriantiacus grows on boiled egg albumen, chiefly as zooglœa. The pigment is soluble in water. (δ) Micrococcus cyaneus, violaceus, chlorinus, and fulvus, produce blue, violet, green, and brown pigment respectively. The first two grow well as zooglœa of elliptical cells on boiled potatoes, the third on boiled egg albumen, and the last is met with on horses' dung.

(*To be continued.*)

A CASE ILLUSTRATING THE BENEFICIAL EFFECTS OF CONVALLARIA.

BY FREDERICK T. ROBERTS, M.D., F.R.C.P.,

Physician to University College Hospital, London, &c.

FOR the following abstract of the notes of the case I am indebted to Mr. T. Wilson, M.B., my house-physician.

W. Carpenter, aged 32, a porter, was admitted into University College Hospital on December 28th, 1883. From the age of fourteen to within the last seven years the patient had been a potman, and had been accustomed to drinking "whatever he could get." For the last seven years he had been a porter, and a moderate drinker. Patient had an attack of rheumatic fever when six years of age. There was nothing worthy of note in the family history.

Three weeks before admission patient's feet began to swell; a week later he noticed that his abdomen was getting larger, and this has gradually increased. There was also a troublesome cough. On admission the present state was as follows:—Patient is a slenderly built man of medium height, with a dark rather sallow complexion. There is but little subcutaneous fat, and the muscles are small and flabby. There is œdema of both lower extremities, reaching as high as the calves. There is considerable ascites, the abdomen being distended and its walls tense. The percussion note is resonant from the ensiform cartilage to an inch and a half below the umbilicus, below which there is dulness. The liver cannot be felt. The splenic dulness is concealed by the fluid in the flanks. The pulse, seventy-eight per minute, is irregular, small, and rather compressible. The heart's impulse is diffused, and extends to an inch outside the nipple-line. The heart's action is irregular. A presystolic

thrill can be felt and murmur heard at the apex, but not very distinctly. The second sound is accentuated at the base, especially over the pulmonary cartilage, and cannot be heard at the apex. The breathing is affected, and the patient cannot lie down. There is a troublesome cough, with copious aërated mucous expectoration. Rhonchal fremitus is felt over both sides of the chest; and the breath sounds are harsh and accompanied by sonoro-sibilant rhonchus all over both lungs, and by large bubbling *râles* at the bases. The urine is greatly diminished, only ten ounces being passed in the day; it is reddish-brown in colour, and of acid reaction. There is a large precipitate of urates on standing; no sugar or albumen. Patient's appetite is bad; he vomits every morning, and has done so for four or five months. The bowels are regular. The tongue is large, indented by the teeth, and slightly furred.

A mixture containing ʒi. of infusion of digitalis to the dose was ordered every four hours.

On January 5th, the œdema of the feet and ankles had almost disappeared, but the ascites had increased so much that the abdomen was tapped, 12 pints of clear straw-coloured serum being withdrawn, a portion of which became solid on heating. After this the urine was slightly increased in quantity for a few days, but never exceeded 24 ounces. On January 8th the girth of the abdomen at the level of the umbilicus was 36 inches. The pulse was more regular—82 per minute. Morning vomiting still continued. The sonoro-sibilant rhonchus had to a large extent disappeared. On the 12th, pleural friction sounds were observed over the base of the left lung; there were no râles over the upper parts of either lung; the cough and expectoration were greatly diminished. Morning vomiting had now ceased. On the 21st the ascites had again increased very considerably, and there was some œdema about the ankles, the patient having been allowed to get up for some days. The urine had never since admission exceeded 24 ounces in the 24 hours; there had been no albumen. Pleural friction still continued over the left base; but the bronchitic *râles* had disappeared. On the 25th the abdomen was very tense and dull all over except over an area extending from the ensiform cartilage to two inches above the umbilicus.

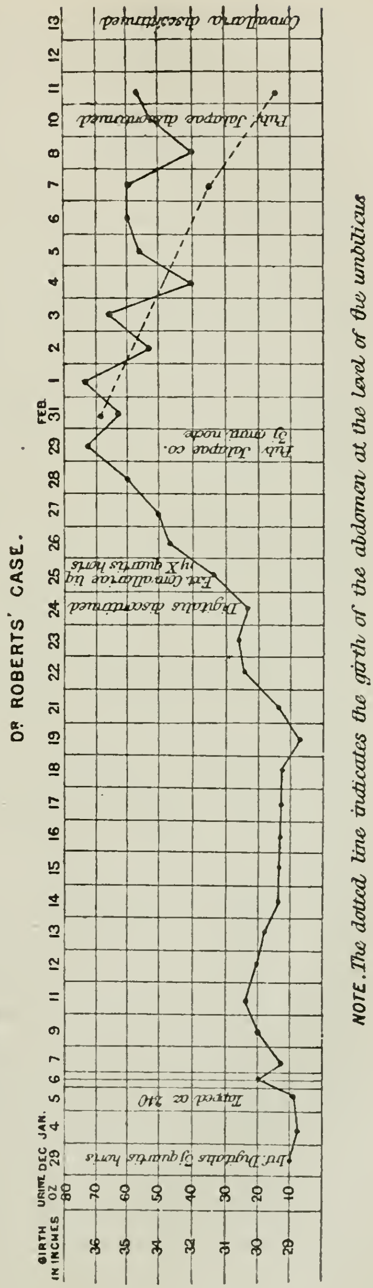
The accompanying chart shows in a graphic way the changes in the amount of urine passed and in the girth of the abdomen.

The digitalis was now discontinued, and ten minims of liquid extract of *Convallaria majalis* ordered every four hours.

The quantity of urine rapidly and steadily increased to 46, 51, 60, and 72 ounces in the 24 hours. The ascites also diminished; the cardiac action became more efficient; and the thrill and murmur more distinct. On the 30th there was resonance down as far as the umbilicus; the girth at the level of the umbilicus was $35\frac{1}{2}$ inches.

A drachm of compound jalap powder was ordered every morning, and this procured two or three watery motions a day.

On February 7th the girth at the umbilicus was $31\frac{1}{2}$ inches; on February 11th, $29\frac{1}{2}$ inches. On the 13th there were no signs of fluid in the abdomen, and no œdema of the legs. The presystolic murmur and thrill were well marked. Friction sounds were still heard over the left base; but no other abnormal pulmonary signs existed.



Appetite fairly good ; no vomiting ; bowels regular ; tongue clean. Liver dulness diminished, the organ cannot be felt. Spleen cannot be felt; dulness somewhat increased.

The *Convallaria* mixture was ordered to be discontinued, and the jalap powder was left off on February 10th.

The patient leaves for Eastbourne in a few days ; and is now free from any evident symptoms.

Remarks.—My experience of the use of convallaria in cases of cardiac disease has not hitherto been so satisfactory as the reports of the value of the drug had led me to expect [*Practitioner*, xxix. 226, 384] ; but in the case just described the good effects resulting from its administration were marked and unmistakable. Practically it might be summed up as a case of mitral obstructive disease, with irregular and inefficient cardiac action ; deficient secretion of urine ; moderate dropsy of the legs ; and considerable ascites. Whether or not the last-mentioned symptom depended partly on morbid changes in the liver is doubtful. The obvious results of the administration of the convallaria were: (1) a distinct improvement in the action of the heart which became more regular and efficient, while the thrill and murmur became more evident; (2) a considerable and progressive increase in the quantity of urine produced ; and (3) rapid diminution and ultimate disappearance of the œdema of the legs and the ascites. The compound jalap powder helped, no doubt, to get rid of the last symptom ; but the other effects noted were unquestionably due to the convallaria, and the increase in the quantity of urine must have been an important factor in removing the dropsical accumulation. I have thought it worth while to report this case in support of the value of convallaria in the treatment of cardiac affections, although I do not for a moment believe that it will entirely supersede other drugs. The patient is now practically well, so far as symptoms are concerned, but the signs of the mitral obstructive disease are very distinct.

A RARE CASE OF PULMONARY ABSCESS.

BY J. MACKENZIE BOOTH, M.A., M.B.,

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On the 15th of October, 1883, I was called to see a dispensary patient living in the basement of a dilapidated old house in one of the worst parts of Aberdeen. The patient was a girl of 13, with a strongly-marked family history of phthisis on the mother's side, two of her aunts having died from pulmonary phthisis, while the mother's life was long in jeopardy from the same disease. The girl herself had repeatedly suffered from attacks of bronchitis, one of which, occurring nearly three years previously, had been exceedingly severe, and, judging from the localised pain, and the occasional cough and spitting, had probably left behind it some catarrhal pneumonia of the right apex. From the recurrence of these bronchitic attacks, joined to the unfavourable hygienic conditions and the poor circumstances of her parents, she had been in weakly health from early childhood.

About three weeks before the day of my visit she had again contracted bronchitis, from which she was convalescent when symptoms set in which induced the parents to send to the dispensary for medical aid. These were a return of the cough, with exacerbations of fever and sweating, disappearance of the spitting, and marked difficulty in breathing, accompanied by dull pain referred especially to the right side of the chest. The appetite had gone, such food as was taken being soon vomited, and the patient was rapidly losing flesh when first seen. She was exceedingly pale and somewhat wasted, with a temperature of 102°·5, the pulse running from 130 to 140, and the breathing

very short and hurried. On percussion, resonance was normal save over the supra-spinous fossa behind the right apex, where there was slight dulness. Auscultation showed crepitant *râles* over the right pulmonary apex before and behind, while over the rest of the lung surface the vesicular murmur was normally heard The cardiac impulse was not visible, and the first sound was very short and weak. The urine was scanty, turbid, and highly-coloured, of a strongly acid reaction and high specific gravity, containing urates in excess but no albumen. The bowels had not been opened for several days. A mild purgative was first given, sinapisms followed by warm linseed poultices applied over the right chest and back, and five minims each of tincture of opium and digitalis ordered to be given every four hours. Small quantities of milk and lime-water, beef-tea, and occasionally port wine, were administered every two or three hours.

During the next few days, save that the vomiting was less, the symptoms grew more and more pronounced—the pulse grew weaker and faster, the breathing quicker and shorter, the face livid, and the strength well-nigh exhausted ; while the mind sometimes wandered, and fitful intervals of drowsiness took the place of sleep.

The percussion note became duller over the greater part of the upper right lobe, being almost flat near the inner end of the clavicle, and shading off into clear resonance towards the third rib in front ; and the crepitant *râles* were replaced by intense bronchial breathing. The skin was either dry and burning, or covered with a clammy sweat. The patient could only be made to take a little wine and water at intervals, and that with much coaxing. At a week's end the temperature stood about 104°, and the pulse could not be counted.

No reason for expecting a favourable termination could be seen, and death was hourly looked for. After a very bad night about four weeks from the commencement of the bronchitis, and eight days after medical aid had been summoned, a severe fit of coughing set in, during which a quantity of yellow pus was spit up. This was followed by another and another fit, and the quantity of purulent matter was such that the patient was nearly choked in its expectoration. When I saw her in the forenoon, the lividity had already partially disappeared and loud

gurgling *râles* were heard over the upper right back, while in front the bronchial breathing still predominated. Percussion dulness was little altered. The fever, respirations, and pulse-rate had fallen considerably, and the patient expressed herself as feeling much easier, though extremely weak. Expectoration was very copious, and remained so for several days, gradually diminishing meanwhile. Percussion dulness gave way gradually, and at times during the next few days resonance was amphoric, and gurgling alternated with cavernous breathing. Carbonate of ammonium in five-grain doses, combined with squills and senega, was given to promote expectoration, and free supplies of port wine were administered and rapidly replaced by a nourishing diet as the appetite returned. At the end of a fortnight, the cough and expectoration had nearly gone, and the patient, who was now rapidly gaining flesh, was able to be up the greater part of the day. The breath-sounds gradually became broncho-vesicular, and dulness had well-nigh disappeared. During this time, also, a painless swelling, seemingly due to infiltration of a lymphatic gland, slowly formed on the right side of the neck, above the pulmonary apex, and this was still present when she was last seen by me towards the end of February. Tonics and hæmatics were also given, along with as liberal a diet as the circumstances of her friends permitted, and at the above-mentioned date the cough and spitting had entirely gone for two months, and the patient was in the enjoyment of better health than she had ever known before.

The supervention of acute pulmonary abscess under such conditions as obtained in the foregoing case is, so far as I can ascertain, an exceedingly rare event. Occurring in a debilitated patient, with a presumable predisposition to phthisis, the extension of a bronchial catarrh to the pulmonary apex, and its localisation there, generally lead to chronic changes in the pulmonary tissue, and not to the rapid processes of acute abscess-formation.

Commencing at the end of the third week of an acute bronchitis, the disease ran a rapid course of between three and four weeks, the consolidation and softening occupying one, while the excavation and cicatrisation took place in rather less than the ensuing three weeks—the whole illness, from the beginning

of the bronchial attack till convalescence was fairly established, lasting about seven weeks.

Probably the presence of old-standing pulmonary catarrh, or the weakness left behind by it, determined the site of the suppurative inflammation; and the expulsion of the old focus of disease, together with the increased blood-supply consequent on the acute process, would suffice to explain the rapid cicatrisation and the thorough restoration to health. But it seems to me difficult to explain the occurrence of such an acute inflammatory attack in the circumstances in which our patient was placed.

The only other cases (two in number) of simple pulmonary abscesses (apart from gangrene with fœtid sputa) which I have met with presented very different conditions. The site of the abscess was the lower part of the lung, the early symptoms were much less acute, and the convalescence more protracted, purulent expectoration lasting over six weeks; and in neither was there a marked phthisical family history.

The first of these occurred as the sequel of acute bronchitis, in a strong, healthy woman of forty, a fortnight after her ninth confinement. A week before labour, after exposure to wet, acute bronchitis set in, and was declining three weeks later, when she began to complain of dull pain under the right mamma and some difficulty of breathing, accompanied by a slight rise of temperature. Dulness on percussion and bronchial breathing, neither very marked, gradually became apparent, and a fortnight later a copious expectoration of pus gave partial relief to the symptoms. The purulent discharge remained for about seven weeks, and its cessation was followed by distinct retraction of the fifth and sixth intercostal spaces in front.

In the second case, that of a boy of three, who had suffered from catarrhal pneumonia, following severe pertussis, after an exacerbation of the pneumonic symptoms a considerable quantity of pus was brought up; as the discharge slowly subsided, the patient (who eventually recovered) was considerably relieved for the time being.

Save in the last case, where the history and the site of the dulness (interscapular) indicated implication of the

bronchial glands, there was little difficulty in the diagnosis of pulmonary abscess. The occurrence of the symptoms in the course of bronchitis, the percussion dulness and bronchial breathing, followed by amphoric resonance aud cavernous sounds in the first, and the visible retraction in the second case, together with the absence of pleurisy or pyothorax, pointed to the lung-substance as the site of the puriform collections. The position of the first in the upper lobe doubtless allowed of the more thorough drainage and early contraction of the abscess cavity as compared with the tardy progress of that in the lower lobe in the patient mentioned second. The absence of fœtor, also, in all these cases renders it likely that the pus was not in contact with the air before it was spit up.

The height of the fever and the profound systemic depression prior to suppuration, necessarily rendered the prognosis a very grave one, and the life of the patient was at a very low ebb indeed when the timely occurrence of the purulent expectoration changed the aspect of the case.

As regards treatment in the two uncomplicated cases, the exhibition of ammonia, squills, and senega afforded much relief by assisting the expectoration of the pus; and the employment of tonics and a liberal diet were marked by beneficial effects in hastening the final restoration to health.

ON THE ACTION AND USE OF DIURETICS.

BY T. LAUDER BRUNTON, M.D., F.R.S.

THE part which water plays in the animal body is a very important one. Not merely does it form by far the greatest part of the body itself, constituting no less than 59 per cent. of its weight, but the life of all the tissues is essentially dependent on its presence in them. Without water no vital function can go on. In the dry climate of Egypt wheat has been preserved unchanged since the days of the Pharaohs, without the slightest tendency to growth having occurred until it was moistened; and when rotifer animalculæ are dried up they will fly about as dust devoid of any appearance of life, until they are again put into the water. In the complicated organisms of the human body the same thing occurs, though to a much less extent. We cannot have any one of the tissues completely desiccated, otherwise it would, like the rotifer, lose all its vital functions, but, unlike it, would not regain them when a fresh supply of water was brought to it. Diminution of water, however, may be endured by the tissues without injury, but diminution will diminish tissue change in them, while increase of water will augment it. When much water is drunk, as certain experiments have shown, the tissue change is increased to such an extent that the body must rapidly waste, and the necessity for more food to supply them is indicated by the ravenous appetite which is induced, as well as by the loss of body weight which occurs when the appetite is not gratified. While water not only increases tissue change, it removes the waste products produced more rapidly than usual, and, indeed, the effect of water-drinking upon the body, in increasing tissue change and removing the waste

products, may be compared to raking out the ashes from a fire, and at the same time making it burn more brightly. All the water drunk must find its way out of the body again by one channel or another. Some of it passes off through the lungs, and a little by the bowels, but the greater proportion passes through the skin and kidneys. The action of these is compensatory.

It is difficult to estimate precisely how much is excreted by the skin, but probably it may be taken at about two-thirds of the quantity eliminated by the kidneys. When the skin is active the kidneys have, consequently, less work to do, and when the secretion from the skin is sluggish, the kidneys must secrete all the more. Some years ago, while making experiments upon the urinary secretion, I found that on the sudden occurrence of a cold day after a succession of warm ones, the amount of urine secreted was very nearly doubled. One reason of this compensatory function of the skin and kidneys probably is that the secretion in both, like the secretion in other glands, depends to a great extent on the supply of blood going to them. When the supply of blood is greater, the secretion is also increased. On a warm day, or when the body is exposed to external warmth, the vessels of the skin dilate, and the cutaneous glands are freely supplied with blood. The application of cold to the surface of the body, on the contrary, causes the cutaneous vessels to contract, and thus more blood is driven to the internal organs—the kidney amongst the rest.

The utility of this arrangement is obvious, for although the skin has an excreting function complementary to that of the kidneys, its chief function is that of regulating the temperature of the body. When the temperature rises either in consequence of active muscular exercise or from any other cause, the vessels of the skin dilate, and if the temperature of the external air be lower than that of the body, heat is lost by radiation. The blood returns cooled from the cutaneous capillaries to the internal organs, and thus the temperature is again brought down to the normal. But even when the temperature of the external air, instead of being lower, is higher than that of the body, the skin still acts as a cooling apparatus by means of the evaporation of sweat. The quantity of heat which is changed

into potential energy in the process of converting liquid water into gaseous steam is very great. Five and a half times as much heat are required to convert boiling water into steam as to raise the same amount of water from the freezing to the boiling point. The immense loss of heat occasioned by the evaporation of the perspiration is so great that in negroes on the west coast of Africa it has been noticed that the skin, while perspiring profusely, is as cold as marble, and Sir Charles Blagdon observed that in a room with a temperature of 128° F. his side felt quite cold to the touch. The skin cooled by perspiration therefore acts even with a high external temperature as a refrigerating apparatus to the blood, and prevents the temperature of the body from rising too high. When the external temperature is low the vessels of the skin contract so that little blood circulates through them, and loss of heat by conduction or radiation or by perspiration is, to a great extent, prevented. It is evident that on a hot, dry day, with active exertion the loss of water by the skin must be considerable, and sometimes work must be done with but a limited supply of water to drink. At the same time the products of waste must be removed, and under such circumstances, although the skin excretes a very large quantity of water, it excretes but a small quantity of solids. The kidneys are thus put to a great disadvantage. They have still to excrete the solids: they can only do so when these solids are in a state of solution, and yet if they excrete the usual amount of water while more than usual is being thrown off from the skin, and, perhaps, less than usual is being drunk, the proper proportion of water in the body will rapidly be reduced below the normal, and its functions seriously disturbed. In order to prevent this there seems to be an arrangement in the kidney whereby water is retained after it has served its purpose of washing the solids so far through the kidneys that they can be afterwards eliminated without it. The products of tissue waste must be removed in a state of solution from the part of the kidney where they are excreted, and yet sometimes provision must be made for the water by which they are washed out being retained in the body. The urine in mammals and amphibia is liquid; in birds and reptiles it is semi-fluid or solid, yet the solid constituents are removed in solution from

the urinary tubules, and the water in which they are dissolved is afterwards absorbed. In cold weather, on the other hand, the vessels of the skin are contracted, there is little or no perspiration and yet it may so happen that the individual is obliged to live on food containing a large proportion of water. This difficulty must also be met, and so in the kidney we have a provision for the removal of water without solids.

We may say then that the kidney has a threefold function :— 1st, that of excretion of waste products; 2ndly, a provision for the removal of excessive water; and 3rdly, an arrangement for the retention of water in the body by its re-absorption, after it has washed out the waste products. On looking at the kidney we find three structures which seem to be connected with these three functions, viz: (1) convoluted tubules with epithelial cells, which in all probability are the chief structures for excreting waste products; (2) the malpighian corpuscles for excreting water along with some solids; and (3) usually one or more constrictions in the tubule which may serve the purpose of preventing too rapid exit of the water, and thus allow time for its re-absorption in cases where its retention is desirable, as for example on a hot day and when the supply of drinking-water is very limited.

The process of secretion in the kidney was regarded by Bowman as consisting of the filtration of water from the vessels of the glomeruli into the tubule, and the excretion of waste products by the epithelium lining the tubule. Ludwig, however, came to look upon it rather as a process of filtration and re-absorption; a dilute solution of urea and salt being according to him poured out from the malpighian corpuscles and gradually concentrated by the absorption of water in its passage along the tubules. This theory had so many facts in its favour that it was for a good while exclusively adopted, but latterly Heidenhain in an admirable series of experiments has shown that substances like indigo are certainly excreted by the epithelium of the tubules. At the same time Hüfner has shown by a comparison of the structure of the kidney in fishes, frogs, tortoises, birds, and mammals, that the form of the tubules closely agrees with that required for the re-absorption of water in each case. Fishes have a low blood-pressure, and so the

resistance in the kidney requires to be small in order to allow of the secretion of urine. Living as they do in water, they do not require any apparatus for its retention in the body. In them therefore the tubule is short and wide, and destitute of any constriction which would retard the outflow of fluid. In frogs there must be ample provision for the retention of water in the body, as evaporation takes place freely from their skin. In them we find, as we might expect, that the tubule, and

IG. 1.—Diagram showing the form of the urinary tubules in different classes of animals, after Hüfner. 1. Fish. 2. Frog. 3. Tortoise. 4. Bird. 5. Mammal. The letters have the same significance in each. *a*. Capsule of the glomerulus. *b*. Convoluted tubule. *c*. Loop. *d*. Collecting tube. *u* in 2 indicates the transverse section of the ureter.

especially the contracted part of it, is very long. In tortoises no evaporation from the skin can take place, and in them the contracted part of the tubule is short. This renders it probable that, while the ideas advanced by Bowman and supported by Heidenhain are in the main true, the re-absorption of water on which Ludwig lays so much stress is also an important facter in the secretion of urine under different circumstances.

But it is not only rendered probable by the facts of comparative anatomy; it appears to be proved by direct experiment.

Ribbert [1] has extirpated the medullary substance of the kidney in the rabbit while leaving the cortical substance. He has thus succeeded in collecting the urine as it is excreted by the malpighian corpuscles before it has passed through Henle's loops, and has found that the urine secreted by the cortical substance alone is much more watery than that which is secreted by the entire kidney, a fact which appears conclusively to prove that water is actually re-absorbed, and the urine rendered more concentrated, during its passage through the tubules in the medullary substance.

In the frog and triton the arrangement of the kidney is such as to allow of a much more complete investigation of the different factors in secretion than in mammals, because in amphibia the glomeruli which separate the water and the tubules which excrete the solids receive their blood supply to a great extent independently. The glomeruli are supplied by branches of the renal artery. The tubules are supplied by a vein which proceeds from the posterior extremities and entering the kidney, breaks up into a capillary plexus bearing a somewhat similar relation to the renal tubules, to that which the portal vein bears to the lobules of the liver. It is therefore called the portal vein of the kidney.

The arterial circulation in the glomeruli and the venous portal circulation round the tubules are, however, not entirely distinct, for the efferent arteries of the glomeruli unite with the portal capillaries, and, moreover, arterial twigs also pass directly from the renal artery into the capillary venous plexus. The two systems are, however, so far distinct that Nussbaum has been able to ascertain with considerable exactitude the part played by each in secretion. By ligaturing the renal artery he destroyed the functional activity of the glomeruli, and by ligaturing the portal vein of the kidney he destroyed that of the tubules. By injecting a substance into the circulation after ligature either of the artery or the vein, and observing whether it is excreted or not, he determines whether it is excreted by the glomeruli or the tubules. In this way he finds that sugar, peptones, and albumen pass out through the glomeruli exclusively, for they are not excreted when the renal arteries are tied. Albumen, however, only passes out through the glomeruli when an

[1] Ribbert, *Virchow's Archiv*, July 1883, p. 189.

abnormal change has already occurred in the vascular wall; as, for example, after the circulation has been arrested for a while by ligature of the renal artery. Indigo-carmine, when injected

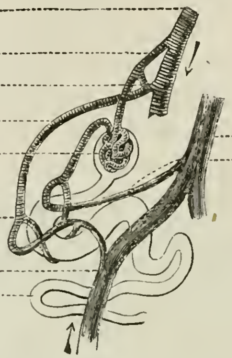


FIG. 2.—Diagram of the circulation in the kidney of the newt. Modified from Nussbaum.

after ligature of the renal arteries, passes into the epithelium of the tubules, but it does not give rise to any secretion of water, so that the bladder is found empty. Urea, on the contrary, is not only excreted by the tubules after ligature of the renal

FIG. 3.—Diagrammatic sketch of the blood-vessels in a mammalian kidney. From Schweigger-Seidel, *Die Nieren*, Halle, 1865. *o* is an artery ascending into the cortical substance of the kidney. *p* is a branch from it which divides into two branches, *q* and *P*. *q* breaks up at once into a number of twigs. *P* is the afferent artery to a glomerulus (*s*) of the lowest row. *t* is the afferent vessel of the glomerulus; it divides into two branches, one of which (*u*) ascends towards the cortex, whilst the other (*v*) descends towards the medulla.

artery, but carries with it, in the process of secretion, from the venous plexus a considerable quantity of water, so that the bladder becomes partially filled.

The excretion of water, therefore, takes place in a double manner: it passes out through the glomeruli when the renal arteries are free, and it passes out from the venous plexus along with urea, even although the renal arteries are tied.

In the kidneys of the higher animals and of man the glomeruli and the tubules do not receive blood from two entirely different sources, but there is an arrangement somewhat similar; for the plexus surrounding the tubules does not receive blood only from the efferent vessels of the malpighian corpuscles, but gets it also directly from the renal arteries. There are three channels by which the blood may pass from the renal arteries into the venous plexus without going through the glomeruli. The first is the inosculation which takes place between the terminal twigs of the renal artery and the venous plexus on the surface of the kidney directly under the capsule. The second channel is formed by small branches given off directly by the interlobular arteries or by the afferent arteries before they reach the glomeruli.[1] The former of these may be regarded as corresponding to the artery which passes directly to the plexus in the newt, and the latter to the branch connecting it with the afferent artery (Fig. 3). These arterial twigs are found not only near the surface of the kidney, but also in the deeper layers of the cortical substance.[2] The third and most important channel is afforded by the arteriæ rectæ, which spring from the branches of the renal artery at the boundary between the cortical and medullary substance and pass into the medulla, where they form a plexus with elongated meshes surrounding Henle's loops and the collecting tubules. Near their origin the arteriæ rectæ inosculate with the venous plexus surrounding the convoluted tubules.

Through these three channels it is possible for blood to reach the secreting structures of the kidney and there get rid of urea, salts, &c., without losing water by its passage through the glomeruli. On the other hand, if these vessels contract, while the size of the renal artery and the pressure of the blood within it remain unaltered, more blood will be forced into the malpighian

[1] Ludwig, *Handwörterbuch d. Physiol.* v. R. Wagner, Bd. 2.

[2] Schweigger-Seidel, *Die Nieren*, p. 67; Heidenhain, *Hermann's Handbuch d. Physiologie*, vol. v. Th. I. p. 293.

corpuscles, and thus the quantity of water excreted will be increased. At the same time the contraction of the arteriæ

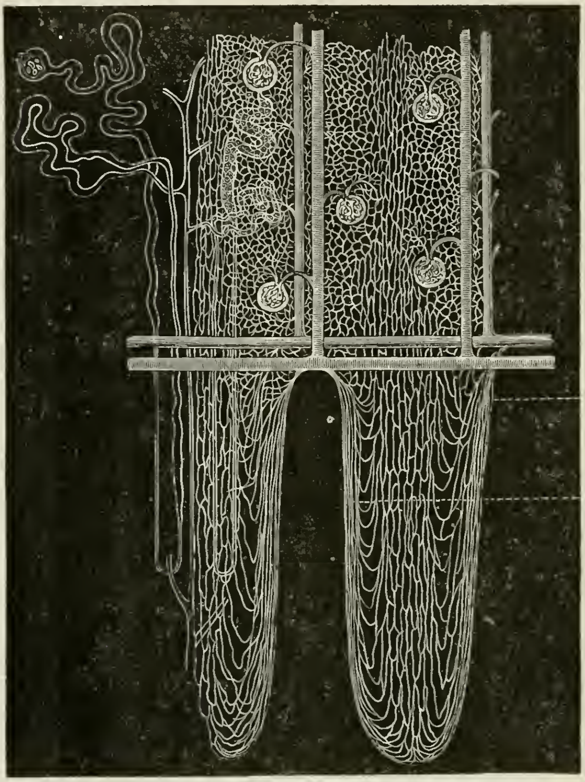


Fig. 4.—Diagram of the tubules and vascular supply of the kidney. On the left is a tubule alone, in the middle is a tubule along with the blood vessels, on the right are blood vessels only.

rectæ will probably diminish absorption from the tubules, and thus the quantity of water excreted will be increased in a two-fold manner.

(*To be continued.*)

Reviews.

Insanity considered in its Medico-Legal relations. By T. R. Buckham, M.A., M.D. Philadelphia: Lippincott and Co. 1883.

Dr. Buckham's object in dealing with this subject is to point out the pernicious uncertainty of verdicts in "insanity trials," to indicate the main causes of this uncertainty, and "to criticise severely and to censure when necessary, not the individuals, but the system which has made insanity trials a reproach to courts, lawyers, and the medical profession." Dr. Buckham proceeds upon the ground that insanity is not and cannot be a disease of the mind, and that what we call mental derangements are the result of imperfections of physical organs. He defines insanity as a diseased or disordered condition or malformation of the physical organs through which the mind receives impressions or manifests its operations, by which the will and judgment are impaired and the conduct rendered irrational. From this decision the author steps on to a new stage of his argument, and concludes that "insanity being the result of physical disease it is a matter of fact to be determined by medical experts, not a matter of law to be decided by legal tests and maxims." Further on in his work the writer speaks of insanity being a question of fact for the jury and not of law for the judges. Dr. Buckham recommends the exclusive employment of a very highly skilled and tested community of experts in the determination of the existence and influence of insanity in criminals who are under trial. The proposal is by no means an original one, and it is very doubtful whether it would be permanently practicable. If the facts relating to a criminal's insanity are clear a jury will be sure to form a correct opinion of them, notwithstanding the blandishments of opposing counsel and the testimony of opposing witnesses. If the facts are not clear the interests of justice would scarcely be forwarded by handing them over to be dealt

with according to the particular theory which a particular specialist might entertain regarding them. If medical science is compromised by the conflict of medical evidence, the remedy is as a general rule in the hands of the witnesses themselves. Dr. Buckham states the matter fully and clearly from his own point of view. We are disposed to think, however, that he places too much stress upon the significance of insanity being a fact, as distinguished from a matter of opinion or definition. There are many facts about which there may be a great diversity of opinion. Neither do we share the author's views with regard to the omniscience and infallibility of experts.

The Book of Health. Edited by Malcolm Morris. 8vo, pp. 1079. London, Paris, and New York: Cassell & Co. 1883.

This new work of Messrs. Cassell's is edited by Mr. Malcolm Morris, and the several articles which it contains are contributed by nineteen authors, each one skilled in the special branch he deals with. Mr. Savory opens the work with a very interesting introductory chapter, in which he details the various functions with which life is associated from birth to death. This article covers a wide scope, entering, as it does, even into such subjects as somnambulism, dreams, the cell theory, and the germ theory of disease. That portion of it which deals with death is powerfully written, and it will have the effect of removing many of the misconceptions which are commonly entertained with respect to the process of dissolution. Dr. Lauder Brunton treats of the influence of stimulants and narcotics on health in all its various aspects; after tracing out the grounds which have led to the use of alcohol by man, its effects both local and general are explained, and then follows a full description of its hereditary influence and its relation to crime, lunacy, and pauperism. As regards the question so frequently asked—"Is alcohol a food?" Dr. Brunton shows that in this respect alcohol much resembles sugar, but that its chief claim to be called a food is the help it affords in sustaining life if given along with other foods. The article concludes with a description of a large number of the various stimulants and narcotics, including tea, coffee, tobacco, betel-nut, &c., together with their physiological actions, and the influence they produce upon the brain and other organs. Education and the Nervous System is dealt with by Dr. Crichton Browne, who has made this subject a special study; and any one desirous of learning how to avoid the various dangers in connexion with excessive or neglected education cannot do better than study this very thoughtful article. The influence of dress forms the subject of a paper by Mr. Frederick Treves, who is admittedly an

authority on the question as to how both man and woman should dress with the greatest regard to comfort and health. Almost every ordinary article of dress is criticised, from the tall hat of man to the woman's stays, and the boots which in both sexes cause distortion of the feet. Finally a so-called hygienic costume is described. Almost every other aspect in which healthiness of the human body can be regarded is expounded by one or another contributor. Thus, healthiness in connexion with special organs, such as the eye, the ear, the teeth, and the skin, is fully discussed, the editor dealing with the last of these subjects. Healthy and unhealthy foods; health in tropical climates; health at school, in the home, and in the various employments in which man engages, all such topics are entered into with a minuteness which is instructive without being wearying. A mere glance at the names of the eminent men who have co-operated in producing the work affords sufficient guarantee that the volume may be accepted as one of authority on the subjects with which it deals, and the editor is to be congratulated on achieving success.

Practical Pathology: A Manual for Students and Practitioners. By G. Sims Woodhead, M.D., F.R.C.P.E., Demonstrator of Pathology in the University of Edinburgh, &c. 8vo, pp. 484, illustrated. Edinburgh: Young J. Pentland. 1883.

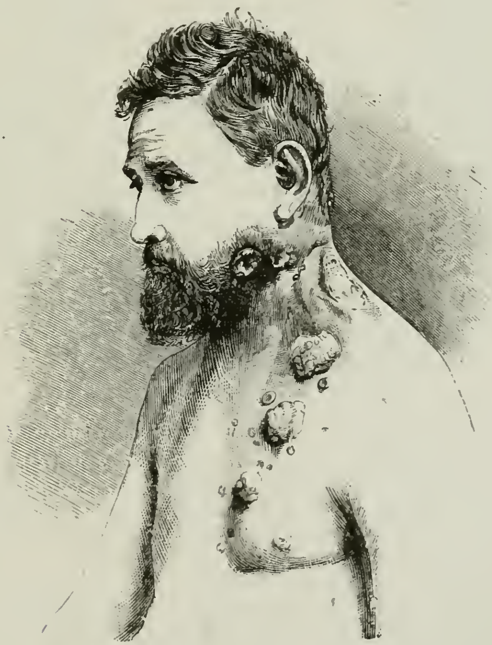
We have to note in this handsome volume three features of interest. First, it is a *practical* treatise, giving the student instructions which will enable him to prepare his own materials and make his own observations on the morbid anatomy of the parts discussed. Secondly, it is illustrated with what are almost *facsimile* representations of the stained microscopic sections, reproduced in all the luxury of modern colouring. Thirdly, it may be regarded as embodying the experience and the results of the very successful classes in practical pathology for which the Edinburgh school has become noted under the fostering guidance of Professors Hamilton and Greenfield.

A short chapter is given on the performance of post-mortem examinations, which is in essence a concise abstract of Virchow's useful little pamphlet: the rest of the book is devoted to histology. The liver, kidney, and lung are treated with much fulness, as might perhaps be expected from consideration of the work done by the heads of the school. In the later chapters, wherein the alimentary canal, the nervous system, and the tumours are considered, there is a somewhat disproportionate brevity and scantiness of illustration, which suggests either that this part had to be hurriedly brought to a close, or that the subjects named are but little thought of in Edinburgh. As the practical classes are doubtless taken in

conjunction with or subsequent to a course of systematic lectures, it is perhaps not to be wondered at that much more is taken for granted by Dr. Woodhead than most students and many practitioners are usually masters of. The "practical" manual will therefore both suggest and require the simultaneous study of "theoretical" manuals, to which it will constitute a highly valuable supplement, and one not furnished by anything hitherto published in this country. We have not quite made out by what process the illustrations, which are worked into the text, have been produced; but in clearness and brilliance they much excel anything effected by mere wood-engraving. Both author and publisher are to be congratulated on the enterprising skill exhibited in these works of art. We do not doubt that a new edition will soon be called for; and if in it a juster proportion between the several parts is maintained the book will surely take a high place in the favour both of teachers and students of pathology.

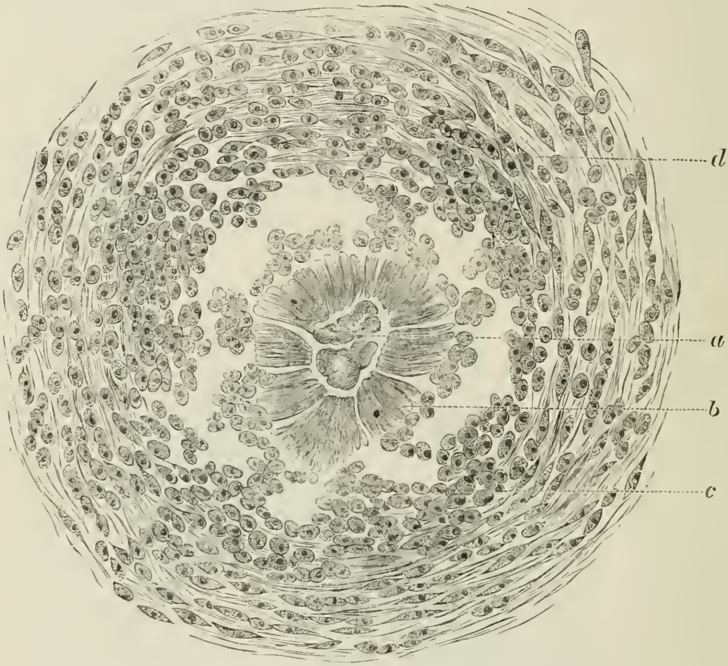
Clinic of the Month.

Case of supposed Actinomycosis.—Mr. W. Knight Treves, of the Margate Hospital for Scrofula, narrates the following case:—P. C——, aged 45, a brick burner, was admitted on



August 17th, 1883, into the Royal Sea-bathing Infirmary under my care, supposed to be suffering from a scrofulous affection of the glands of the neck. He is a powerfully-built, muscular man, with a good family history. His illness began sixteen months before admission with inflammation about the neck and angle of the

jaw, which, however, only kept him from work some two or three days. He has lived well and been in a comfortable position for his class in life. He has never had cattle to look after. A lump by the angle of the jaw followed the inflammation, which was incised. Subsequently other swellings formed. When first seen he was in fair general health and well nourished. Over the angle of the jaw and in the posterior triangle of the neck were three ulcerated and fungating surfaces, those by the angle of the



NODULE CONTAINING THE ACTINOMYCES OR RAY-FUNGUS (× 300).
After Sims Woodhead (*Pract. Pathology*, p. 474).

Specimen taken from the tongue of a cow, and stained with Spiller's blue. *a.* Central core, or supposed mycelium. *b.* Radiating bodies or supposed conidia. *c.* Epithelioid cells in the surrounding granulation-tissue. *d.* Cells forming new fibrous or cicatricial tissue.

jaw being about one inch, and that in the posterior triangle about two inches in diameter. There were tumours over the collar-bone, the second rib, and the fourth costal cartilage near the sternum, each of which was in a direct line, and had followed in regular order the one described as existing in the posterior triangle. These tumours resemble each other in appearance; they are smooth and evenly formed, and are in shape as nearly as possible half a sphere; the upper one is two inches in diameter,

the lower one an inch, and the middle one intermediate in size; they have an elastic, semi-fluctuating feel; the skin over the upper one is thin, red, and evidently about to give way; the skin of the middle one is also discoloured, that of the lowest is normal. To the right and left of these tumours are two nodules about the size of a marble, apparently the same thing in process of formation. The discharge was thin and serous and contained minute yellowish masses, and disintegrated tissue, and had a peculiarly offensive and sour smell. The patient declined operative interference. He remained in the hospital till December 7th, the progress of the case being marked by gradual loss of flesh, formation of lumps on the other side of the neck and in the axilla. The three tumours described became broken down, and he presented before his discharge the appearance given in the woodcut, which is from a photograph. The appearance of these tumours resembled nothing that I had ever seen before. The case was certainly not scrofulous; nor was it like any new growth with which I was familiar. I arrived at the conclusion that it was an example of the disease known as actinomycosis. This diagnosis was confirmed by the discovery under the microscope of bodies which I believed to resemble the fungus described as peculiar to this disease. So far as I can ascertain, this is the first case of actinomycosis described in this country. (*Lancet*, Jan. 19, 1884.)

Pathology of Actinomycosis.—The fungus-like parasite *Actinomyces* which gives rise to this disease has been demonstrated both in man and the lower animals. Its manifestations are characteristically seen in certain giant-celled tumours not uncommon on the jaws of oxen, and in ulcerated nodules or tubercles which occur in the mucous membrane of the mouth and nose in these animals. Purulent points or cavities are frequent in such growths, and in man, indeed, the outcome of the disease is suppuration rather than tumour-growth. In abscesses thus formed the parasite is evident even to the naked eye as a gelatinous body, or many such, the size of millet-seed, floating in the pus, and this body when teased out has the appearance of a mycelial structure. It is also probable that the crystalline bodies which have been observed on opening certain abscesses are the result of calcification of the fungus, a change which it is apt to undergo. The bovine tumours present on section a translucent, greyish-yellow, lardaceous aspect, with here and there centres of suppuration, and are dotted with yellowish spots the size of a pin's head, which are the points of development of the fungus. The microscope shows that each of these contains a number of rounded bodies of mulberry-like appearance sometimes enclosed in calcareous capsules. Each of

these again owes its characters to the possession of a central mycelium of matted filaments, out of which radiate thread-like processes, clubbed at the ends with what seem to be spore-bearing conidia. Extension of the disease takes place by continuity, and also by metastasis. In the latter case, all the organs are liable to be affected, but especially the lungs. The lung in actinomycosis is studded with masses of the organism resembling centres of acute tuberculosis; these tend to break down and form cavities; there is subpleural œdema and purulent effusion into the pleura. It is to be noted that notwithstanding its usually injurious effects, *Actinomyces* has been found in the normal human tonsil, and would therefore seem to be incapable of development in the tissues except under special conditions. Birch-Hirschfeld, on the other hand, relates a case of faucial inflammation due to it. Here sulphurous applications resulted in recovery. The biological position of the *Actinomyces* has been disputed. Rivolta at first referred it to the animal, but observers now agree in referring it to the vegetable kingdom. It has been successfully cultivated by Israel on coagulated blood-serum. The calf is its most suitable host (Johne), though the tissues of man and the dog may also furnish its proper pabulum. (*Progrès Médical,* Feb. 16, 1884.)

Tissue-change in Liver-Diseases.—Dr. Stadelmann finds that in interstitial hepatitis the excretion of ammonia in the urine is increased as compared with that of urea, the increase corresponding to the amount of disease. Sometimes it may reach four times the normal ratio, which is about 2·5 or 2·8 of ammonia to 100 of urea. In severe cases there is always a considerable increase in the absolute amount of ammonia excreted. Along with this there is often a very considerable diminution in the amount of urea. The author has not found leucin or tyrosin in any of his cases, but has found peptones in considerable quantity. The quantity of peptone varies in the different cases, and in the same case at different times; on some days the quantity is large, and on other days very small. Along with the diminution in the excretion of urea a diminution in that of sodium chloride takes place, which runs tolerably parallel with the lessening of urea, but is still more extensive. In interstitial hepatitis the excretion of sodium chloride is particularly small, and is less than in cancer of the liver. Only in one case was sarcolactic acid found in any quantity; and in another a considerable amount of benzoic acid was noticed in the urine. (*Deut. Archiv f. klin. Med.* p. 526, vol. xxxiii.)

Resection of Wounded Blood-vessels.—The following case, reported by Dr. W. Baum, differs in its clinical history

from that published by Tillmanns (*Berliner klin. Wochens.* vol. xviii. No. 3) in that in this case resection was performed on three bleeding vessels. H. S., æt. thirteen years, was brought to the Stadt-Lazareth in Danzig, on July 5th, 1883. One hour before, while cutting a wooden shoe, the knife slipped, and went into the left thigh. Profuse hæmorrhage occurred, but was almost immediately checked by digital compression. Dr. Suchanneck, on seeing the patient, enveloped the limb with a rubber-bandage from the toes upward to the wound, and then applied an Esmarch's tube above. The patient had lost but little blood, the senses were entirely clear, and the strength and pulse were far better than would have been supposed after so severe a wound. After being taken to the hospital, the bandage was removed from the leg, and the wound was seen to be about three-fifths of an inch long, with smooth borders on the inner surface, and very near the middle of the thigh. After cleaning and disinfecting the leg, Baum extended the wound on both sides. The edges were scarcely ecchymosed, and it was only necessary to remove a few clots in order to see the vessels clearly. The femoral vein was first brought into view, a conical clot closing up the wound in its wall; when this was removed some bleeding occurred, which quickly ceased on the application of a ligature below and above the wound: the piece between the ligatures was now cut out, about four-fifths of an inch. This resected piece showed two smooth perforations through the anterior and posterior walls, each four-tenths of an inch long. The femoral artery, being wounded, was treated in the same manner. A musculo-articular branch being also wounded was resected, after which, the Esmarch's tube being removed, the wound remained bloodless. The edges of the wound were now brought together, the whole extremity enveloped in antiseptic dressing from the toes to the hip-joint, and the limb placed in a horizontal position. The temperature went up to a little above 100° Fahr., and during the first few days the patient complained of a slight amount of pain in the limb, but it was not so great as to interfere with his sleep. On the morning after the operation, the toes were somewhat coloured, and the last phalanx of the great toe seemed to be anæsthetic, but this entirely passed away by the following day. On August 2nd the patient was discharged, with perfect use of the leg. Baum also reports the case of a man, æt. 46, who had carcinoma of the penis, with enlarged carcinomatous glands in the groins. The penis was removed by the *écraseur*, and the glands in the left groin extirpated. The femoral artery and vein were so involved with the carcinomatous glands that pieces one and one-fifth of an inch were resected from each. About a week afterwards, the glands on the right side were extirpated. No

accident occurred, and the patient recovered. (*Berlin. klin. Wochens.* Oct. 22, 1883.)

Pressure in the Treatment of Suppurating Buboes.—Professor O. Petersen treats buboes, after fluctuation is clearly determined, as follows :—A large incision is made, and the cavity of the abscess is cleaned out with a sharp spoon. The bleeding is stopped, and iodoform powder is applied. Then comes the pressure bandage, which is the important factor in this treatment, and its application is as follows: First a ball or wad of salicylic cotton, or some soft pliable material made antiseptic with salicylic acid, is formed of the size of the cavity, and placed over it ; upon this wad are then placed several layers of the same material ; then a second ball or wad made of tow or oakum, and about four times as large as the first, is placed upon this. Over this oil-skin or wax-paper, and the whole is firmly fastened with a gauze or elastic bandage. This bandage remains unmolested, as a rule, from seven to ten days. The average length of healing, in a trial for three years of this method, was twenty-three days ; previously the average was from seventy to ninety days. Twenty per cent. of the cases healed under one bandage, twenty-five under two, twenty under three ; more than seven bandages were in no case necessary. The average number of bandages was two. (*Centralblatt für Chirurgie*, Nov. 17, 1883.)

The Pathology of Hemichorea.—An interesting case of this affection is published by M. Mabboux, in the *Revue de Médecine* for December 1883. His patient was a young soldier, aged twenty-three, who had been for some time under treatment for melancholia with various delusions. One morning he was discovered to have hemichorea of the right side, more marked in the arm than leg ; twitching of the right side of his face had been observed occasionally during the few preceding days, but no importance had been attached to it. A careful examination of the patient elicited the fact that there were neither paralysis nor anæsthesia of the affected limbs, nor was any cause found for the movements. From this time the patient rapidly grew worse, the movements became more violent, the melancholia more intense, and he died sixteen days after the hemichorea was first observed. The author on repeated occasions examined the patient, but never found paralysis or anæsthesia. On examination a blood clot was found in the left lenticulo-optic region, surrounded by a zone of softening; the hæmorrhage involved the internal capsule, but not the most posterior portion of it, invading also the postero-external part of the optic thalamus and the tail of the corpus striatum. The mental symptoms were fully accounted for by a tolerably extensive chronic fronto-parietal meningo-encephalitis. M. Mabboux

explains the absence of hemiplegia by the slight degree to which the corpus striatum and optic thalamus were involved, and the absence of anæsthesia by the fact that the most posterior portion of the internal capsule was intact. But it seems to us that too much stress ought not to be laid upon the supposed absence of hemiplegia and hemianæsthesia in this case, for accurate observation on either of these points was impossible, at any rate during the last week of the patient's life. (*Med. Times*, Jan. 5, 1884.)

Tuberculous Infection through Food.—In the *Bayerisches ärztl. Intelligenz-Blatt*, 1883, No. 26, Herzerich reports the history of two girls, sisters, aged respectively fifteen and three months, who after being nursed by an undoubtedly phthisical mother—the first for five months, the second for three—were reared and fed on soup, milk, and pap. The mother adopted the following disgusting method of feeding:—She first chewed the food herself, then spat it out into a spoon, and gave it to the children. So long as she had little expectoration the children bore this feeding well; but so soon as her expectoration became abundant, although the children continued to take their food with appetite, they both rapidly emaciated; ulcers formed in the throat and insides of the cheeks, some large and of irregular shape, others small and round, both with infiltrated edges; and extensive swelling of the lympathic glands occurred. Severe fever, putrid diarrhœa, and progressive atrophy, caused the death of both children within a month of one another. The *post-mortem* appearances were the same in both. All the mediastinal lymphatic glands were swollen and caseated; caseous nodules occurred under the pleuræ and scattered throughout the lungs, also in the liver, spleen, and of smaller size in the kidneys—in other words, there was present *tuberculosis pulmonum, hepatis, renum et lienis, lymphadenitis caseosa.* The mother survived the children for some months, and died after extensive destruction of the lungs had occurred. It is worthy of remark that her children by a former marriage showed no sign of phthisis; also that the two children in question, so long as they were suckled by a comparatively healthy mother, remained themselves healthy. As the author says—"This important case has all the value of a pathological experiment, and must be considered as a pure case of tuberculosis derived from infected food." (*Dublin Journ. Med. Science*, Dec. 1883.)

The Inheritance of Tuberculosis.—The question of the inheritance of tubercular disease is one which is capable of wide application. The fact of such inheritance is undoubted, but the manner of it is still a moot point. Unlike syphilis, there are,

we believe, no instances on record of congenital tuberculosis—*i.e.* of the actual transmission of the disease from parent to offspring before birth—and the cases of tuberculous disease manifesting itself in very early infancy are but few. Hence it has been plausibly maintained that what is inherited in tuberculosis is not the actual disease itself; there is no transmission, it is held, of the tubercle-virus, but only of a tendency or disposition which renders the offspring of tuberculous parents more prone to the disease when placed under conditions favouring its development. Some experiments described by Landouzy and Martin in the December (1883) number of the *Revue de Médecine* tend to disprove the ordinarily received notion, and to favour the idea of the actual transmission of tuberculosis as of syphilis. Their plan was to employ for inoculation-experiments, under precautions to avoid contamination, portions of a tuberculous lung from a pregnant woman (five months), of the placenta, which appeared healthy, and of the blood and tissues of the fœtus. The inoculations were made on the guinea-pig, and tuberculosis was inducted in the animal. The disease was again transmitted to another guinea-pig by inoculation. Should such researches be verified, they would justify the assertion of those observers that the fœtus may inherit the actual disease from the mother. But it is also a fact that tuberculosis is inherited on the paternal side; and accordingly they tested this experimentally by inoculating guinea-pigs with portions of the apparently healthy testicle and semen from a tuberculous guinea-pig, also with a positive result. Without denying that a tendency or peculiar disposition of tissues to become tuberculous is an important fact in the inherited taint, Landouzy and Martin find sufficient warrant for the belief that there is an actual transmission of the virus also. The inheritance of tuberculosis may, they say, be like the inheritance of fortunes. The children of wealthy parents inherit their riches; other children inherit the means whereby they may become rich in after-life. Some children are born tuberculous, others are born with the capacity of becoming tuberculous; the former inherit the grain itself, the others only the soil, which sooner or later favours the growth of the tuberculous seed that by chance is implanted in it. (*Lancet*, Jan. 19, 1884.)

Extracts from British and Foreign Journals.

Precipitates in Mixtures of Different Tinctures.—M. Pierre Vigier (*Gaz. hebdom. de med. et de chir.*, July 13, 1883) calls attention to the precipitates that are sometimes formed in mixing tinctures. Physicians often prescribe mixtures of different tinctures to be taken by drops. Such mixtures are very often turbid, perhaps because the tinctures which compose them are made of alcohol of different strengths; perhaps because there is some chemical incompatibility in the substances mixed together. Sixty per cent. alcohol, which is nearly half water, dissolves the gummy matters of plants, which are precipitated by stronger alcohol. On the other hand, 80 or 90 per cent. alcohol dissolves the resinous matters, which are precipitated by weaker alcohol. In case a precipitate forms in any given case, the liquid can, of course, be filtered, but it is often not known what remains upon the filter. It is well, therefore, in mixing tinctures, to put together such only as are made with alcohol of the same strength. However, even this precaution will not always prevent the formation of precipitates. For instance, if equal quantities of the tinctures of calumba, of gentian, of cinchona, and of the bitter tincture of Baumé be mixed together, the resulting compound is turbid. It is found, by combining these tinctures in various ways, that the precipitate results from the reaction of the tinctures of calumba and of cinchona upon each other. The viscous material contained in the tincture of calumba is thrown down by the soluble principles of the cinchona. This precipitation may not destroy the value of the filtered mixture; nevertheless it is better not to prescribe the two tinctures together. (*Dublin Journ. Med. Science*, Nov. 1883.)

Perosmic Acid in Neuralgia.—The latest agent introduced for the relief of neuralgia is a 1 per cent. solution of hyperosmic or perosmic acid, administered by subcutaneous injection. It has been employed in Billroth's clinic in a few cases. One of the patients had been a martyr to sciatica for years, and had

tried innumerable remedies, including the application of electricity no fewer than 200 times, whilst for a whole year he had adopted vegetarianism. Billroth injected the above remedy between the tuber ischii and trochanter, and within a day or two the pain was greatly relieved, and eventually quite disappeared. It would be rash to conclude too much from these results, in the face of the intractability of neuralgiæ to medication, but if it really prove to be as efficacious as considered, perosmic acid will be a therapeutic agent of no mean value. (*Lancet*, Nov. 24, 1883.)

Alcohol for Students.—Dr. Clouston, of Edinburgh, has recently delivered an extremely sensible and useful address on the "Effects of the Excessive Use of Alcohol on the Mental Function of the Brain," to the students of the University of Edinburgh. He does not take the position of a preacher of "abstinence," but of moderation. He says, "You will understand that I have nothing to do with any use of alcohol which cannot be truly said to be excessive—that is, probably damaging or dangerous to the mental power of the brain." In this view of the subject we are thoroughly with him; and in another matter to which he alludes at the close of his lecture, we are, if possible, even more thoroughly of his way of thinking. "To conclude—looking at the university student, taking into account the period of life at which you study, the work you have to do, the unfavourable conditions of life in which you have to live from a physiological point of view (there is no physiologist who will for a moment pretend that sitting in a stuffy class-room for four or five hours a day is in itself a good thing for a young man), taking the long cold period of our Scotch dark winters, when we cannot get enough out-door exercise; taking the fact that neither you nor I know the weak points of our constitutions as derived from our ancestry—taking all these things into consideration, I think that a student will have little reason to blame himself who totally abstains from alcohol during his period of study. You will all admit that a man who does so avoids certain manifest risks; most of you will admit that he will do more work; you will all admit that he does not lose very much of the best kind of social enjoyment during his period of study; you will all admit that after his studies are over, and when he has developed into full manhood, he will be likely to enjoy it all the better, as well as more safely, if he takes to the moderate use of alcohol. After that some of the risks are over. And if he should remain a total abstainer all his life, it may not be the worst thing he can do. I am not here suggesting to you what I did not practise myself, for during four years of my studies I was a total abstainer, and it

was a course I never have had any reason to regret." Students should lay this address to heart. The present writer, by no means a partisan of the teetotal craze, was, like Dr. Clouston, an abstainer during his student life, not professedly, but as a matter of physiological expediency, and not only does he not regret it, but he is convinced that he succeeded far better without alcohol than he would have done with it. (*Lancet*, Jan. 26, 1884.)

Action of Aconite and Aconitine.—In a large monograph Laborde and Duquesnel have given the results of their observations on aconite. According to Laborde aconitine acts chiefly upon the medulla oblongata and spinal cord. It abolishes first sensation and afterwards reflex action. It does not affect the excitability of the motor nerves in physiological doses. In somewhat larger doses it increases the amplitude of muscular contraction as seen in the myographic tracing, at the same time that irregularities and intermittencies appear. In a rapidly fatal dose the motor power is quickly abolished, but the muscular continuity disappears almost at the same time as excitability of the motor nerve. Motor inco-ordination is one of the first and essential manifestations of poisoning by aconite. In regard to its action on the heart of the frog, they find a short period of acceleration with diminished amplitude and irregularity, which may pass into a sort of tetanic condition. This is succeeded by greatly increased energy and amplitude of the contractions. This is followed by a third stage of gradual weakening and intermittencies, which is, however, not due to paralysis of the cardiac muscle. The chief action of aconite on the heart is exerted through the pneumo-gastric nerves. The blood-pressure is temporarily increased, and then diminished. The peripheral temperature runs a parallel course with the circulation. The respiration is irregular, the irregularity being chiefly due to spasmodic action of the respiratory muscles, both of the dilators of the thorax and the glottis. Death occurs through the respiration, not through the heart, and artificial respiration is useful both in preventing and curing poisoning by aconitine. It produces vomiting and diarrhœa, apparently due to the irritant action of the poison on the gastro-intestinal mucous membrane. When injected subcutaneously it is probably eliminated by this membrane, and produces the same symptoms as when taken by the mouth. At the commencement of the poisoning there is alternate dilatation and contraction of the pupil, with tendency to myosis, and the same result is produced by the local application of aconitine to the eye. Later on there is progressive and extreme mydriasis. This dilatation is probably a reflex phenomenon due to irritation of the gastro-intestinal mucous membrane

and to asphyxia. Aconitine acts on most of the excretory organs in different degrees, the liver being chiefly affected, then the salivary glands, kidneys, and intestines. The first effect is primary, and directly due to the action of the poison on the central nervous system. The second is due to the effect of the poison on the glandular elements by which it is excreted. Aconite when once absorbed does not remain long in the blood, and if the greater part of the blood of a poisoned dog be introduced into the veins of another healthy dog, even a few minutes after poisoning has commenced, no symptoms of poisoning are produced in the second animal. [Compare the apparently different conclusions of Plugge in *Practitioner*, xxix. 136.] (*Revue de Médecine*, Sept. 1883.)

Diet in Tuberculosis.—Dr. A. Bidder, of Berlin, concludes three articles on the relation between the alkalies of the food and the ætiology of tuberculosis, by advocating a diet as free from potassium salts as possible, but rich in common salt, as being a sodium salt. He argues that the latter renders the tissues unfavourable to the development of the bacilli of tubercle, and that in young patients with tuberculous processes going on in the bones, joints, glands, lungs, &c., half a gramme to one gramme of common salt should be given three or four times daily with the food, according to age. If dislike to this be shown, benzoate of sodium may be substituted in doses of 0·2 to 0·5 gramme (3 to 7·7 grains). Indeed, the latter salt (known to be useful in the summer diarrhœa of children) is highly relished; it is aromatic in taste, and increases the appetite. Bidder thinks, moreover, that the well-known injurious influence of iodide of potassium upon tuberculosis and on scrofulous processes is probably due not to the iodine but the potassium, which is replaced by sodium in the stomach. The diet should contain an excess of albumen, of fat, and of salt in the cases mentioned. The article concludes by a reference to rickets, in which a connexion with tuberculosis is attempted to be proved. Rickets is here said to be due to an excess of potassium salts in the food, as *one* cause at least. (*Berl. klin. Woch.* 47, 1883.)

Immediate Application of the Splint in the Treatment of Whitlow.—Dr. Illingworth writes that, in the treatment of whitlow, not only is early and deep incision essential, but that it is necessary to place the finger at once on a back splint, and to dress it frequently, so as to prevent all movement, and so favour healing, until the edges of the sheath of the tendons have properly united. By this means extensive suppuration is prevented, and the cure is more rapid. (*Lancet*, Oct. 13, 1883.)

Cause and Mechanism of Flat-Foot.—Dr. Hermann von Meyer, Professor of Anatomy in Zürich, after a careful examination of the normal and of the flat foot, anatomical as well as clinical, comes to the following conclusions, which, as will be seen, are somewhat at variance with the generally accepted views:—Flat-foot does not depend on destruction of the arch of the foot, but on a valgous position of the foot, and chiefly of the os calcis, with regard to the astragalus, together with, as a complemental and secondary condition, version upwards and outwards of the fore-part of the foot. The deformity is not due to relaxation of the plantar ligaments, but depends rather on exaggerated rotation inwards of the astragalus, and on subsequent changes in the conditions of the plantar bones due to the atrophy resulting from mutual pressure. The present brochure (*Studien über den Mechanismus des Fusses*, part i., published at Jena) is the first of three in which the normal and pathological conditions of the foot are to be discussed. We shall look forward to the others with some interest; the second will deal with the normal mechanism of the foot, and the last will complete the subject by discussing the various forms of club-foot. (*Med. Times*, Dec. 29, 1883.)

Treatment of Hay Fever and allied Disorders.—In a valuable paper on this subject, Dr. Harrison Allen claims that the means of effecting the cure of this hitherto considered incurable disease is simply to overcome the tendency to obstruction in the nasal chambers. The symptoms of hay fever are always associated with some degree of obstruction of one or both nasal chambers. One cause of this obstruction is dilatation of the blood-vessels. There is no doubt that the local phenomena are in most instances the same, and that the multiform related symptoms, such as injection of the eye, headache, malaise, asthma, &c., are due to reflex vasomotor disturbances. But many patients apply for treatment who exhibit swelling of the nasal mucous membrane, occlusion of the respiratory passages, and mucoid or semi-purulent discharge, without any of the related reflex phenomena. Yet a third and intermediate group exhibit perhaps a tendency to turgescence of the mucous membrane, together with one or more of the more common constitutional symptoms of typical hay fever. Indeed, there is nothing peculiar to the disease just named save its sharply-defined periodicity, particularly in that phase of it where the periods of recurrence happen to coincide with the time of fruitage of certain plants, or the gathering of certain crops. In a small group of cases, where, in addition, other signs and symptoms become prominent which would invalidate the above proposition, Dr. Allen is inclined to attribute them to mental impression,—in some of the

varied phases of hysterical or neurotic excitement. Or the case may be stated in different language, as follows: In an imperfectly defined group of cases of nasal catarrh, a sensation of sudden obstruction of one or both nasal chambers is a conspicuous symptom. This sensation is constantly accompanied by a change in the chambers themselves, viz. engorgement of the membranes over the turbinated bones, producing pressure against the septum and occlusion of the respiratory passages of the nose. The sensations are recurrent, but vary greatly as to the time of the day or the season of their return. With some patients they are nocturnal, and are associated with the recumbent position; with others they occur after meals only; with some they occur in the summer season; with others, yet again, in the winter. The sensations may be confined to either chamber, or be present in both. In aggravated cases they are associated with numerous reflex symptoms, among which may be mentioned lacrimation and hyperæsthesia of the conjunctiva, headache, and dyspnœa. Patients having a disposition to obstruction during the summer and autumn report themselves as suffering from "hay fever"; while those having alternating attacks in the right and the left chambers report with "nasal catarrh." The cases so far studied exhibit one feature in common, viz. that the inferior turbinated bones lie well above the plane of the floor of the nasal vestibule. In many persons, not the subjects of "hay-fever" and allied disorders, the lower free portion, including, of course, the inferior border of the bone, lies below the plane of the floor of the nasal vestibule; and in ordinary inspection the inferior meatus is out of sight. It will thus be seen that the mucous membrane, which is known to be the most erectile, is also the most exposed to irritation from extraneous substances and to changes in the temperature of the surrounding air. The conclusions to be drawn from the study of the six cases reported by Dr. Allen may be summarised briefly as follows: (1) That the treatment of all conditions of obstruction in the nasal chambers, no matter from what cause arising, can be successfully carried out by destroying the causes of obstruction. If the cause be an overgrowth of bone-tissue, it must be filed, sawn, or drilled away. If it be caused by a deviation of the cartilaginous portion of the septum, such portion must be reset in a new place. If, as is often the case, it is due to periodic turgescence of the mucous membrane or the resulting secondary hypertrophies, such growths must be destroyed, either by the galvano-cautery, by the snare, or by caustic acids. (2) That the treatment of hay fever and allied periodically recurring nasal affections in no way differs from the treatment of other nasal diseases accompanied by obstruction, and that the treatment may be conducted during an attack as well as in the intervals between

any two attacks. (*American Journal of the Medical Sciences*, Jan. 1884.)

Acute Eczema caused by Anacardium orientale.—Dr. Wesener describes a case of acute eczema beginning at the head and face and spreading over the whole body, caused by wearing round the neck the fruit of *Anacardium orientale* as a remedy for headache. The eczema in the face was accompanied by so much swelling as at first to resemble erysipelas, but was distinguished from it by the absence of fever. It remained in one part of the body or another for between two and three weeks, and the redness of the skin was succeeded by papules, vesicles, and pustules, which dried up into scales. The *Anacardium orientale*, or Malacca-bean tree, like the *Anacardium occidentale*, or cashew-nut tree, contains a caustic oil, called cardol. That from the Malacca-bean tree is called *cardoleum pruriens*, and that from the cashew-nut *cardoleum vesicans*. When the *cardoleum pruriens* is applied to the skin, it produces, after several hours, vesicles, which contain some pus, gradually run together, dry into crusts, and heal after suppurating for a length of time. The balsam contained in the nut has a more gentle action, and generally produces vesicles filled with clear or somewhat turbid fluid. These dry up and heal, the skin generally desquamating. The intensity of the action depends upon the constitution of the patient. The purulent contents of the vesicles contain cardol. When the application is carefully made, the action remains local, and at the most slight infiltration of the neighbouring parts may occur; but if the contents of the vesicles are conveyed to other parts of the body, by scratching or friction of the clothes, they produce dermatitis, which, according to the amount of the fluid and the constitution of the individual, may produce large or small vesicles, or only simple rubefaction. The conditions which might otherwise render cardol preferable to cantharidin are counterbalanced by its being so readily conveyed to other parts of the body. In order to prevent its convection when therapeutically applied, the place of application must be carefully guarded by covering, bandaging, &c. In consequence of this its therapeutic use is too complicated, and not to be recommended. When given internally, the cardol is apparently excreted through the kidneys. The results of experiments on these organs vary: sometimes it has caused no albumen to appear in the urine, but in other experiments the cortical substance of the kidney has been found hyperæmic, and albumen has been found in the urine. It is probable, though not certain, that this may occur from the external application of cardol. Both the balsam and the cardol from the *Anacardium occidentale*

appear to have a somewhat greater action than that from the oriental kind. (*Deut. Archiv f. klin. Med.* p. 578, vol. xxxi.)

Hyoscyamine in Insanity.—Dr. Henry M. Hurd of the Eastern Michigan Asylum states (*American Journal of Insanity*) that Merck's Amorphous Hyoscyamine in doses of $\frac{1}{24}$ to $\frac{1}{20}$ of a grain controls convulsive seizures and prevents excitement or irritability. In a discussion regarding the merits of this drug by the Canada Medical Association in September last, Dr. Metcalfe of Kingston said that used hypodermically, hyoscyamine acted more quickly and surely than any other narcotic. He gives from $\frac{1}{12}$ to $\frac{1}{10}$ of a grain hypodermically. Maniacs require larger doses than melancholics. Dr. Hurd of Pontiac, Dr. Clark of Toronto, and Dr. Troutman of New York, commended the drug highly in mania and melancholia. [*Practitioner*, xxxii. 367.] (*Canada Med. and Surg. Journ.* Sept. 1883.)

Malt Liquors in Alcoholic Insanity.—Dr. Lewis D. Mason, physician to the Inebriate Asylum, Fort Hamilton, states that when stimulants are needed in *mania a potu* malt liquors are to be preferred to spirituous liquors. He recommends Bass's ale, Guinness's stout, or Lager beer, and considers that this preference is justified by the nourishing, moderately stimulating, and marked sedative or even hypnotic properties of malt stimulants. (*American Journal of Neurology and Psychiatry*, August 1883.)

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*** Any of the foreign works may be procured on application to Messrs. Dulau, of Soho Square, W.C.; Williams and Norgate, of Henrietta Street, Covent Garden, W.C.; or Baillière, of King William Street, Charing Cross.

Department of Public Health.

SOME ACCOUNT OF PNEUMONIA (INFECTIOUS) AT DOLTON, IN THE SPRING MONTHS OF 1883.

BY E. SLADE-KING, M.D. (*Medical Officer of Health*), AND SLOANE MICHELL M.R.C.S.

THE Great Torrington rural sanitary district is divided into five registration sub-districts, fairly equal in size and population. The people are a healthy well-developed race, engaged, with some trifling exceptions, in agriculture.

The general death-rate is under 16 per 1,000 living. Within five months ending May 30th, 1883, the pneumonia deaths were 15—thus distributed : in the sub-district of High Bickington 3, Winkleigh 1, Dolton 10, Shebbear 0, Torrington 1.

In four districts the deaths were as to time and place irregular, but in Dolton nine were registered between April 3rd and May 10th. In Dolton the area of sickness was limited, covering a small outlying portion of Dolton, named Rock Cottages, the hamlet of New Bridge in Huish, separated from Dolton only by the stream of the Torridge, Petrockstow, one and a half miles west of New Bridge, and Merton, two miles north of New Bridge.

Taking New Bridge as a centre, the population within the area thus defined does not exceed 500. The general sanitary conditions are satisfactory ; the cottages and farms are of the better class ; and cattle disease has been almost unknown. The months of January and February were mild and damp. But March and a large part of April were cold, dry, and windy

Mr. Tattam, a local meteorological observer, has kindly furnished the following notes from his records. In March the winds blew from the E., N.E., or S.E. for 22 days, N. or N.W. for 8 days, S. 1 day. In April E. or N.E. 18 days, N. or N.W. 11 days, S. 1 day. He describes the winds of March and April as pungent, piercing, cold and dry, and he adds that he can find no account of a March in North Devon with so low a mean temperature since 1845.

In sheet 26 of the ordnance map, between Petrockstow and Merton villages, at about equal distances from Torrington and Hatherleigh, there lies, in a direction N. 30° W. to S. 30° E., a flat alluvial tract, four and a half miles in length by about three-quarters of a mile in breadth. The surface is not a dead level, but rises towards its borders, formed of encircling hills of culmiferous shale. Here are the well-known "Petrockstow deposits" of clay-quartz gravel and sand. These deposits are lacustrine, and it is partly on the slope of the hills surrounding this old lake basin, partly along the valley between Merton and Huish, excavated by the outflow of the pent-up waters of this now dried-up lake, that the cottages and farmhouse to be referred to mostly stand.

We propose to give some account of the history of pneumonia occurring within the time and area above defined, dividing the cases into some four or five groups, as most convenient for reference.

Group 1.—In the end of January Mrs. M., a farmer's wife living at Addleshole Farm, Exbourne, North Devon, sickened with an acute pneumonia of base of left lung: during her illness she was visited, about January 30th, by her mother, who stayed to nurse her. Her mother was Mrs. B., *æt.* 65, resident at Rock Cottages, Dolton; she suffered from mitral disease of old standing. On February 7th she returned home in consequence of feeling much too unwell to continue to nurse her sick daughter; she rapidly developed pneumonia and died March 2nd. During her illness her second daughter, E. B., *æt.* 34, single, in sound health, housekeeper at Huish Rectory, returned home to Rock Cottages to nurse her mother; on March 3rd or 4th she in her turn developed pneumonia, but recovered.

Group 2.—In this group the patients all lived in the hamlet of New Bridge, separated only by a shallow river from Rock Cottages, Dolton. These cottages, situated close together, are modern buildings of a superior class, standing on a gentle eminence, rising above the highway, and overlooking the bridge and river. The initial case was that of Jane Dillyn, a married woman, *æt.* 29. Three weeks after her confinement, that is on the 31st of January, 1883, she was attacked with well-marked broncho-pneumonia, which has terminated in chronic phthisis; she is still living. On February 20th Bessie Dillyn, *æt.* 9, living in the same cottage, was attacked with pneumonia, followed by peritonitis; she recovered. In the cottage next adjoining Jane Dillyn's lived her mother, Mrs. N., a married woman of say 60 years. She was naturally much with her daughter during her illness, and was most anxious about her. Over-fatigued with nursing, on March 2nd she developed pneumonia, and died on the 31st of that month. She was jaundiced for a week or ten days before her death. Mrs. N. was closely confined during her illness to her bed-chamber, a spacious room. For the first few days of her illness her husband shared her bed; on March 9th, seven days from the commencement of his wife's sickness, Mr. N. was attacked with a well-marked pneumonia. There was no history of fatigue or exposure to wind and weather; he made a good recovery. Mrs. Horn, a hale woman, *æt.* 55, came to New Bridge to nurse Mrs. N. and her daughter. On March 31st she developed pneumonia, and was doing so well that on the tenth day she was permitted to sit up. Three days afterwards phlebitis of the internal saphenous vein —midway between the knee and ankle—showed itself, and she died very suddenly from embolism on May Day.

The medical history of New Bridge deserves further notice. In a cottage some sixty or seventy yards distant from Mrs. N.'s lived James Cockwill, *æt.* 36. On April 13th he was suddenly attacked with erysipelatous inflammation of his tonsils. The tongue and entire buccal mucous membrane became much swollen, endangering his life by suffocation, spreading externally over face and head, and finally he died five days after (April 18th) from asthenia and bronchitis, resulting apparently from the same specific inflammation extending down to the bronchial

tubes. Three of his children, a girl *æt.* 4, and a few days afterwards two boys, were confined to their beds with general malaise, and a high temperature. No lung symptoms were however developed. Anne Lugg, *æt.* 54, living just opposite Mrs. N.'s cottage, where she had given neighbourly assistance, was suddenly attacked with high temperature, which subsided in the course of some four or five days. Mary West and Kate West, mother and daughter, living next door to Cockwill, were similarly attacked, the most prominent symptom being high temperature. Kate fell ill on the 18th of April, the mother a week after. So that in fact at the hamlet of New Bridge, consisting of six dwellings, in five there was sickness, apparently of an infectious character.

Group 3.—The history of these cases may be given in a very few words: Mrs. T., of Stone Farm, is ill with pneumonia, acute, well-marked; her niece, Miss B., comes on February 27th or 28th from the neighbouring village of Petersmarland, in which no pneumonia is existing, to nurse her aunt. She is a healthy robust girl, yet on March 7th she falls ill with pneumonia; both patients recovered.

Group 4.—Cases connected with the village of Merton, two miles north-west of New Bridge. Albert Spicer, *æt.* 18, in service at Petrockstow, one and a half miles west of New Bridge, returned to his home at Merton in the beginning of March (exact date lost) suffering from acute pneumonia; he made a good recovery. Emily Spicer, sister of the above, *æt.* 16, an anæmic girl, but in sufficiently good health to fulfil her duties as a pupil teacher, was sitting working in Merton Rectory on April 7th, when she was seized with a shivering fit, taken home and placed under immediate treatment, but died of pneumonia on the 18th. Louis Spicer, brother, *æt.* 11, was attacked with pneumonia April 11th, but recovered. John Stacey, *æt.* 65, attacked with pneumonia April 5th, died April 12th. E. Stevens, *æt.* 4, attacked with pneumonia April 6th, recovered. These two lived in adjacent cottages at the distant end of Merton village; no communication with the Spicers known of. J. H., *æt.* 50, coachman at Merton Rectory, a sufferer from chronic asthma, was attacked with pneumonia April 23rd and died on the 28th. He passed the Spicers' cottage in going to and from his daily

work, and called on them three or four times to enquire after their health. The only other fatal case in Merton parish was James Bright, he lived outside the village; taken ill on April 16th, he died on the 22nd.

Group 5 includes John Ward, *æt.* 52; sickened March 25th, died April 2nd. Anne Smale, *æt.* 80, sickened on May-day, died on the 7th. Mary Heale, *æt.* 84, sickened May 5th, but recovered. Mary H. was a constant visitor on Anne Smale during her illness. These persons were all residents in Petrockstow village.

Group 6.—Harry Bowden, *æt.* 7, son of the Lord Clinton's farm bailiff, Huish parish, was attacked June 5th, and recovered. His sister Jane, *æt.* 13, sickened June 14th; her illness was very acute, but she ultimately recovered.

So many deaths from pneumonia occurring so rapidly among a population so small, inhabiting so small an area, naturally attracted considerable local attention on the part of medical men and the general public. The popular impression was that it was "a catching disease." The nurses and friends of the sick held the idea that it was sickness of a character which was new to them. All were struck with its infectious nature, and constant applications were made to the sanitary officers to do something to check its spread. Was this disease ordinary pneumonia?

The prodromata, the physical signs, the sputa, duration, were those which accompany pneumonia. There was no rash visible. The temperatures were those of average cases. The type was mostly adynamic, and among the older patients albumen was found as usual in the urine. Jaundice and peritonitis were the not unexpected complications.

The mortality among men was, in proportion to persons attacked, greater than among women. This agrees with Dr. Longstaff's tables, which show 1,460 deaths of males from pneumonia to every 1,000 of females. There was no difference of opinion among the medical attendants as to the characters of the disease. Had each case stood alone, it would have attracted no special observation.

Was the behaviour of pneumonia at Dolton such as to warrant its being classed as a specific infective disease?

It is true that the majority of the cases sickened during

the cold weather of March and April, but the initial cases of Groups 1 and 2 occurred in February when the weather was mild, dull, and soft; and the last group sickened in June. This very much accords with Dr. Longstaff's proposition that "While the mortality from pneumonia appears to be mainly regulated by intense cold and the cold winds of early spring, the occasional want of correspondence between the assumed causes and the effects suggests that possibly pneumonia, or many of the cases so designated, may be communicable, or they may be complications of a communicable disease, more or less fatal, according to the prevailing meteorological conditions."

Group 1 furnishes cases in regular sequence. The initial case occurs at the end of January; the next on February 7th; the last on March 31st.

In Group 2 the dates of the cases are January 31st, February 20th, March 2nd, March 9th, March 31st; and this succession obtains more or less throughout.

Again, the groups are not artificial; they are composed of individuals naturally coming into close contact; just the people we should expect to be most readily infected.

In Group No. 1, Mrs. B., the mother, receives the infection from one daughter and conveys it to another; all three were associated in the relation of patients and nurses.

In Group No. 2, Jane Dillyn infects her daughter and her mother, Mrs. N. She in her turn infects her husband, and the pair of them infect Mrs. Horn, the paid nurse. In the last group, Harry Bowden infects his sister Jane.

Persons of all ages were liable to this infection; their years varied from seven to eighty-four.

There is some indication that the disease did not become manifest till at least seven days after the first personal contact of healthy with sick.

Mrs. B., in Group 1, complained of illness on February 7th, the eighth day after she had gone to her daughter at Exbourne.

Mr. N., in Group 2, under medical observation, developed pneumonia exactly seven days after his wife's seizure.

Jane Bowden, also under medical observation, sickens very severely eight days after the commencement of her brother's attack.

On the other hand, Emily and Louis Spicer are certainly in contact with their brother Albert on his return home in the beginning of March, yet they do not develop pneumonia till the 7th and 11th of April.

Klebs and Friedländer have shown the constant presence of a particular form of micrococci in pneumonia. Were these organisms conveyed to the healthy during close personal contact with the sick, in many cases producing pneumonia?

Did they, in other instances, prove abortive at an early stage of their lodgment in the human body, producing in one case erysipelas and bronchitis, and in five other persons those sudden high temperatures which were noted among the inhabitants of New Bridge other than the pneumonia patients?

One other point may be noticed. There were many circumstances tending to limit the infection—if infection it was—nothing to favour its spread. The sanitary circumstances of the dwelling-houses were good. A personal inspection of these houses was carefully made; there was nothing to note as regards dampness, nuisances, water-supply, overcrowding, or drainage. The ventilation of the bed-chambers was generally defective, and the cold wind prevented any temporary remedy from proving useful. The Lord Clinton and the rector of Merton took great personal interest in the sick. They provided good nurses, ample nourishment, and neighbourly assistance of all kinds. The medical treatment was prompt and based on most careful clinical observations. The infectious character of the outbreak was recognised by the sanitary authority at an early date—certainly by the first week in March—and every sanitary precaution save total isolation was used. The medical men in attendance considered the cases as infectious, and rendered most generous and invaluable assistance to the sanitary officers in carrying out the details of their work.

The writers of this history are fully aware of its great incompleteness. They however claim the merit of having endeavoured to record the facts in an impartial manner. For the inferences drawn from the facts the Medical Officer of Health is alone responsible.

SOME NOTES ON THE CHOLERA AT DAMIETTA IN 1883.

BY W. I. SIMPSON, M.D.,
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In England, even with a special sanitary service, a medical registration of deaths, and no lack of medical men, there is often a difficulty in tracing an outbreak of epidemic disease to its first case. If the enquiry reaches so far successfully, a new difficulty arises, for one important step is still required, and that is, to determine what was the cause of this first case. Was the disease imported, or did it originate *de novo?* Frequently it becomes evident that it was an importation, but as frequently the origin of the first case is wrapped in obscurity, and doubt is left on the investigator's mind whether it might not have originated spontaneously. We find some medical men explaining the commencement of an epidemic by spontaneous origin, and others equally convinced that this explanation is erroneous. As such differences of opinion exist here in a highly endowed country, it can be no matter of surprise that in Egypt, where civilisation is of a different kind, and where facilities for investigation are absent, there is want of agreement concerning the cause of the recent epidemic of cholera. Some are of opinion that the recent cholera was imported, some that it arose spontaneously, and others that it is endemic in the country. The evidence on which these opinions are based is for the most part scanty, and one opinion, so far as proof goes, is worth as much as the other. It is in order to help to elucidate this important question that I have put together notes made during a few days' stay at Damietta.

Dr. Salem Pasha, the learned President of the Board of Health, through Dr. Grant Bey, of Cairo, kindly gave me every assistance in his power to forward my enquiries. In passing I may mention that the German Commission was there three days, and Dr. (now Sir William Guyer) Hunter one day. I found four days far too short, and regretted much I had no longer time at my disposal, for I was only enabled to dip but slightly into the important problem.

In Egypt there are very few medical men, the demand for them being small, as the Egyptians are not in the habit of seeking medical advice. Excepting a few who have studied in European schools, the generality of the medical men know very little of medicine, and none have any conception of sanitary science.

The Government appoints a doctor to a wide district, pays him a small salary, and expects him to minister to the wants of the patients who may apply to him ; but as the majority never apply, he is not hard-worked.

In Damietta there resides one doctor who is entrusted with the health of the people in the town and surrounding country. The population is estimated at over 30,000 inhabitants. The deaths are registered by a secretary, and the causes of death, gleaned from the statements of the friends, are put down in the register in a haphazard manner, much according to the tastes and preferences of the secretary. With such a wide area and so large a population, it is inconceivable that the medical man could have an accurate or even a general notion of the causes of death, except in the few instances where he has been called in during the illness. It is absolutely impossible that he should have any trustworthy information of the prevailing diseases at any particular time in his district. It is said that the local medical man should know best the most likely origin of the disease, but after the above explanation it will be readily discerned that all those advantages which, in other circumstances, he would have derived from special education, position, and experience, and which would have most fitted him to give a valuable opinion on the causes of the epidemic, or give material aid to other investigators, are entirely wanting.

To the stranger there are additional drawbacks to contend with. The Egyptians have a natural dread of being questioned, through fear of compromising themselves unawares. Possibly this fear is engendered from the arbitrary and despotic powers their superiors sometimes capriciously exercise over them. Whether this is so or not, the inhabitants have an unpleasant habit of stating whatever will suit themselves, or they express the views most in favour at the time, or contradict themselves so often as to leave one in doubt what they really know or mean to convey. Numerous examples of this phase of their character came under my observation ; I will mention two.

One morning a consul's servant, in great grief, told his master that his (the servant's) child had died the previous evening of cholera, and that two of the elder children were now attacked with vomiting and purging, and were seriously ill. Asked if he had sought medical advice, he replied, "No, it was useless, for if his children died it was the will of God, and no one could prevent it." The consul, however, insisted on a doctor being sent for. The man did as he was bid, and informed the doctor of the child's death. An autopsy was suggested. This alarmed the father, and he immediately decided to say nothing about the other children, but hurried home and hid them. Afterwards he declared that they were quite well, and positively denied he had ever said they were ill. He also induced a number of his friends to come forward and testify that the children were quite well, and that neither the elder children nor the one that died ever had vomiting or purging. The doctor saw the body of the dead child, and certified that it had died from diphtheria.

Another curious incident occurred when enquiry was made of a respectable man about his wife who had died of cholera. First he said his wife died at a friend's house; a few moments after he declared she had died at home, and possibly thinking he had been too definite, he finally remarked he could not remember.

It is well understood at Damietta that the Governor of the district is strongly of the opinion that the cholera was imported into Egypt by the English ships coming from India. This view suits both his political and social leanings, his hate of the English and his love for filth. From a reliable source I learn that the present Governor has been in Damietta about six years. The town was in a much better sanitary condition before his administration commenced; it was then cleaner, and some attention was given to scavenging; now, cleaning is only a process for particular occasions. When it was understood that Dr. Hunter would visit the town, the inhabitants, by forced labour, were employed for three days in scavenging. The town underwent a similar purification before the visit of the German Commission. The latter cleansing has been considered sufficient, for none has been done since that time.

Damietta is a small town of nearly 30,000 inhabitants, situated on the banks of the Nile about four miles from the sea. The river, just before it reaches the sea, takes rather a sudden

bend and runs into a deep basin; after passing the town, it again becomes shallow, and this shallowness is still further increased by the bar at the river's mouth. The result of this is that when the Nile is at low-water the water in front of Damietta is slow-flowing, indeed almost stagnant, and whatever may at that time be thrown into the river is carried into the basin and remains there, and the same happens with any material from the town. When the river is high the current is then comparatively rapid, and sweeps away impurities thrown into it. The houses along the bank for the most part come quite up to the river side; many small trading-boats lie alongside these houses. The boats come chiefly from the small islands in the Archipelago, from Greece, from the Syrian coast, and a few from Port Said. Those from Port Said have two routes, some come by sea, others cross the Menzaleh Lake. The sailors are chiefly Greeks, Syrians, and natives; there are no English among them. There is plenty of communication between Port Said and Damietta, for many of the former inhabitants of Damietta have left and reside at Port Said, so that there are always natives crossing over from Port Said to see their friends and relations at Damietta, and *vice versâ.* There is also an interchange of merchandise between the two towns. The manufactures in Damietta are silk and cotton goods. The people, who appear to be poor, are fond of fish, which they seem to prefer in a rather putrid state. The chief institution in the town is the fishmarket. There are numerous cafés, frequented by sailors, mostly Arabs and Syrians. There are no squares, gardens, open spaces, or places of recreation. The whole town consists of narrow, irregular, unpaved, and undrained lanes. The site is low-lying, and the soil, consisting of alluvium deposited by the Nile, is damp; and after rain it is swampy. The air is odorous with nauseating and miasmatic vapours, constantly given off from stagnant pools filled with decomposing animal and vegetable matter. Green pools, with gases bubbling up from them, are seen in every part of the town.

It had been raining the day before I arrived, and it was amusing to see the Arab children take off their scanty clothing, enter the puddles in the streets, play, bathe, and roll in them, and come out covered from head to foot in a coating of mud and mire. Even in the best parts of the town it was difficult to go from one side of the street to the other.

The inhabitants, when they trouble themselves to be so far cleanly, which I am given to understand is not always the case, and of this I myself had ocular demonstration, throw all their slops and refuse in front of the door or near the dwelling. This practice is the cause of the above-mentioned fermenting mass of half-solid and half-liquid matter: there it lies, rots, soaks into the soil, and gives forth its offensive and dangerous exhalations. The street and surroundings of the house are the common sewer and cesspool for the town. Of all the disgusting places, offensive alike to the sense of sight and smell to a European, the latrines and baths attached to the mosques are the worst, because of their overpowering stench. Long before they are reached the evil odour they send forth distinguishes them. The cemeteries also add their share, and in this town of filth and stinks there is not one redeeming feature.

The impression given to the visitor is that Damietta has been a larger and more important town than at present; the houses appear to be too numerous for the sparse inhabitants. The best-class houses are large and fairly built, but are very old and falling into ruins. Invariably the lower apartments are uninhabited, generally used for stores or rubbish, and always very filthy. In the quarter where the cholera first violently broke out, and in many other parts of the town, the houses are one-storied, badly built, and half in ruins. They are chiefly made of a compost of mud, manure, and straw. The floor is simply the soil on which the hovels, for they can be called nothing else, are erected. There is frequently a slightly raised portion of the ground which does duty for a bed; on this there may or may not be a mat; several apertures in the sides of the hut near the roof act for windows and ventilators, but little air or sunshine gains admission by these holes, so that the inside of the dwelling is dark and sometimes damp. It is often strewed with rubbish. There is no furniture, but sharing the cabin are such animals as the inmates may happen to keep.

The inhabitants live mostly out of doors, and use their houses chiefly for shelter at night. Those who live in the houses on the banks of the Nile, or near the canal which runs through the town, empty their refuse into the water; they also wash their clothes, utensils, and themselves in the Nile or canal, and draw their drinking water from the same source. I have seen a

woman empty the filthiest liquid into the river, and another woman come immediately after and fill her pitcher with water for drinking purposes from the same spot before the water had become again clear. The Arabs do not filter their water, but prefer it from the Nile with whatever it may contain. To them filtered water is as distasteful as distilled water to most people.

All European notions of sanitation are outraged in this town. I have mentioned pollution of soil, air, and water. I have yet to add tainted and diseased meat. It was about the beginning of February that bovine typhus broke out at Damietta, and extended up the river to other villages and towns. Though there is no direct charge exacted for burying these animals, there are indirect ones, and the owners prefer to throw the carcases, *minus* the hides, into the river, both because it is easier and because it costs nothing. Mr. Goodall, who was employed by the Egyptian Government to superintend the clearing of the east branch of the Nile, and with whom I had the advantage of a conversation, took out 400 putrid carcases in one week, most of them being in the vicinity of Damietta, and the majority of them being in such a decomposed condition as to make it impossible to drag them out of the river except in pieces. The work was of an intensely offensive and sickening nature, and the carcases as they accumulated produced a pestilential state both of the air and of the water. This cattle plague had appeared in and around Damietta in the four previous years, but not to the same appalling extent.

Notwithstanding the insanitary condition of the town which I have described, Damietta is to the Arab's mind a healthy spot. It is cooler than many parts of Egypt. The native physicians send their patients here to recover their health; whether they do so or not is another matter. The idea of Damietta in its present condition as a health resort seems to be about the most distorted fancy ever entertained, and reminds one of the notion of the Spanish physician of a former century, who maintained that human ordure kept inside houses was good for health, because it absorbed all noxious vapours. There are some smells, however, that the Egyptians strongly object to, namely, those of carbolic acid and chloride of lime. It is believed that they induce abortions and other untoward accidents.

The general state of health in Damietta may perhaps be gauged by the number of deaths.

This table shows the number of deaths in the several years from 1860 to 1882:—

Year.	Deaths.	Year.	Deaths.
1860	1,103	1872	1,230
1861	941	1873	1,274
1862	1,502	1874	1,196
1863	1,096	1875	1,537
1864	1,092	1876	1,591
1865	3,747	1877	1,449
1866	987	1878	1,259
1867	1,120	1879	957
1868	911	1880	1,237
1869	1,004	1881	1,112
1870	929	1882	1,061
1871	1,143		

Whether all the deaths are registered I am unable to say. The above is the official death return. The healthiest year has a death-rate of nearly 30 per 1,000. Some years have 50 per 1,000. The cholera year of 1865 has over 100 per 1,000, and there were over 100 per 1,000 in 1883. No wonder Damietta looks desolate.

To those responsible for the good sanitary condition of a country it is not palatable to have it asserted that a disease has arisen and ravaged the country from neglect of duty on their part, and it is quite to be expected that the accused would seek out some other cause than the one which brings the blame home to themselves. The members of the Egyptian Board of Health are just now in this position; and naturally enough cling to the opinion that the recent cholera was imported, and that it spread by contagion independently of any sanitary conditions. They believe that it came from India. So far as importation goes, they are, I understand, supported in their views both by the French and German Commissioners.

Before stating my opinion about importation, it may be useful to compare the two epidemics of 1865 and 1883 with regard to time, duration, and intensity.

The following table shows the deaths in the two epidemics o cholera in Damietta:—

Date. 1865.		Number of Deaths.	Date. 1883.		Number of Deaths.
—		—	June	22nd	6
—		—	,,	23rd	13
—		—	,,	24th	15
—		—	,,	25th	28
Ba-una	20th[1]	1	,,	26th	37
,,	21st	10	,,	27th	113
,,	22nd	35	,,	28th	101
,,	23rd	53	,,	29th	113
,,	24th	67	,,	30th	110
,,	25th	93	July	1st	141
,,	26th	107	,,	2nd	130
,,	27th	142	,,	3rd	110
,,	28th	157	,,	4th	111
,,	29th	172	,,	5th	109
,,	30th	171	,,	6th	107
Abib	1st	169	,,	7th	92
,,	2nd	166	,,	8th	88
,,	3rd	172	,,	9th	53
,,	4th	121	,,	10th	52
,,	5th	102	,,	11th	65
,,	6th	112	,,	12th	40
,,	7th	73	,,	13th	38
,,	8th	72	,,	14th	38
,,	9th	84	,,	15th	35
,,	10th	50	,,	16th	27
,,	11th	43	,,	17th	18
,,	12th	42	,,	18th	17
,,	13th	21	,,	19th	22
,,	14th	18	,,	20th	7
,,	15th	14	,,	21st	14
,,	16th	13	,,	22nd	6
,,	17th	7	,,	23rd	8
,,	18th	10	,,	24th	16
,,	19th	8	,,	25th	5
,,	20th	11	,,	26th	4
,,	21st	12	,,	27th	3
,,	22nd	7	,,	28th	3
,,	23rd	13	,,	29th	5
,,	24th	5	,,	30th	2
,,	25th	5	,,	31st	3
,,	26th	2	August	1st	6
,,	27th	4	,,	2nd	0
,,	28th	2	,,	3rd	0
,,	29th	2	,,	4th	3
,,	30th	0	,,	5th	0
Misra	1st	2	,,	6th	2
,,	2nd	3	,,	7th	0
,,	3rd	1	,,	8th	3
,,	4th	0	,,	9th	0
,,	5th	0	,,	10th	0
,,	6th	0	,,	11th	0
,,	7th	0	,,	12th	0
,,	8th	0	,,	13th	1
,,	9th	1			

[1] The 20th of Ba-una corresponds to our 26th of June.

The two epidemics show some interesting points of resemblance. They commenced about the same time of the year, when the Nile was at its lowest. They caused, within five or six days of their appearance, over 100 deaths a day. They continued at a high death-rate for ten or eleven days, and then they gradually subsided and disappeared about the time when the Nile had considerably risen. The epidemic of 1865 lasted fifty days and destroyed 2,376 persons; that of 1883 lasted fifty-three days and destroyed 1,928 persons. The only material point of difference is that the epidemic of 1883, in spite of all its attending circumstances of filth, diseased meat, and polluted water, was actually less severe than the previous epidemic.[1] This however, may be accounted for by the active measures taken to clear the Nile and by the steps adopted to purify the town; but a more potent agency, in my opinion, than these and others put together was the earlier and more rapid rise of the Nile. It gave clear and fresh water to the people, in spite of their filthy habits. It was like a new water supply granted to them and seemed to have the almost immediate effect of staying the epidemic. Whatever may have been the origin of cholera at Damietta, there is little doubt its rapid spread was mainly due to the defilement of the water.

[1] Since writing the above I have received a letter from Dr. Mackie of Alexandria, in which he states that the population of Damietta was larger in 1865 than in 1883.

(*To be continued.*)

THE PRACTITIONER.

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Original Communications.

MICRO-ORGANISMS AND DISEASE.

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(*Continued from* p. 264.)

CHAPTER VII. (*continued*).

Clathrocystis roseo-persicina (Cohn), peach-coloured bacterium, Bact. rubescens (Lankester), is an organism of about 0·0025 mm. in diameter, spherical or oval and of a bright red colour. The cells differ from micrococcus prodigiosus, not only in their greater size and their intrinsic colour, but also in this—that having formed zooglœa-masses there are gradually developed cavities or cysts therein, which are filled with water, while the coloured cells occupy their periphery. The cysts ultimately break up. Together with this organism occur other pink-coloured organisms described by Cohn as *monades*.

Monas vinosa, spherical cells about 0·002 – 0·003 mm. in diameter.

Monas Okenii, cylindrical cells, 0·008 – 0·005 mm. long, 0·005 mm. broad, flagellate.

Rhabdomonas rosea, spindle-shaped, 0·004 mm. broad, 0·02 – 0·03 mm. long, flagellate.

Monas Warmingii, spindle-shaped, 0·008 mm. broad, 0·015 – 0·020 mm. long, flagellate.

Ascococcus.—Billroth first described certain peculiar spherical, oval, or knobbed masses of minute micrococci, which he found in putrid meat infusion. Each of the masses is enveloped in a resistent firm hyaline capsule of about 0·010 to 0·015 mm. thickness. The masses are of various sizes, from 0·02 to 0·07 mm. in diameter, and are composed of small spherical micrococci. Cohn found them also in his (Cohn's) nourishing fluid (see Chapter II. A. 7) where they produce the peculiar smell of cheese. They are capable of changing acid nourishing material into alkaline. Cohn called the organism *ascococcus.*

Fig. 14.—Ascococcus, after Cohn.

Sarcina ventriculi.—Goodsir was the first to describe in the vomit of some patients, peculiar groups of four cubical cells, with rounded edges, and closely placed against one another. These *sarcinæ ventriculi* are of a greenish or reddish colour. The diameter of the individual cells is about 0·004 mm. They are found in the contents of the stomach of man and brutes in health and disease, where the groups of four cells form smaller and larger aggregations. Occasionally small sarcinæ occur on boiled potatoes, egg albumen, and gelatine exposed to the air. These sarcinæ are

considerably smaller than the sarcina ventriculi, and when in large quantities have a yellowish tinge. Like the sarcina ventriculi they are in groups of four, and these again occur in larger or smaller aggregations and zooglœa. I have cultivated them successfully through many generations in pork broth, beef broth, mixture of gelatine and broth, at ordinary temperatures and in the incubator; more easily however at ordinary temperatures.

(*d*) *Pathogenic micrococci.* Many of these are connected with disease. In the pus of open wounds,[1] and in that of closed abscesses, occur micrococci, singly, in dumb-bells, and in colonies or short chains,[2] but there are certain acute inflammations, *e.g.* that produced by subcutaneous injection of turpentine, the pus of which does not contain micrococci or any other organisms.[3]

The secretion of open ulcers, such as occur in ordinary acute inflammations of the skin and mucous membranes, in ulcerations of the throat due to scarlatina, in every ulceration of the

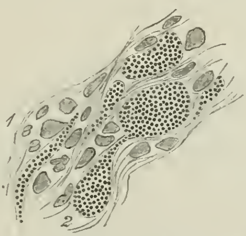

FIG. 15.—FROM THE BASE OF AN ULCER OF THE MUCOUS MEMBRANE OF THE LARYNX IN A CHILD THAT DIED OF ACUTE SCARLATINA.

1. Nuclei and fibres of the tissue.
2. Zooglœa of micrococci.

intestinal mucous membrane, in the lymph of the vesicles of the skin and mucous membranes of the mouth occurring in various kinds of inflammations, there are almost always present micrococci in dumb-bells, often also in beautiful chains. In the ulcers and abscesses they often form continuous masses, *i.e.* zooglœa, encroaching upon the tissue of the base of the ulcer. To this category belong the minute micrococci (about 0·0005 mm.

[1] W. Cheyne, *Path. Transact.* xxx.

[2] Ogston, "Micrococcus in Acute Abscesses," *Br. Med. Journal*, March 12, 1881.

[3] Uskoff, *Virchow's Archiv*, vol. 86, i. p. 150.

in diameter) which Klebs described as microsporon septicum, found in and around wounds. The spread of purulent inflammation in connective tissues and in parenchymatous organs is often, if micrococci are present in the original focus, associated with a corresponding spreading of the micrococci; these easily grow into all the spaces and crevices of the tissues, but whether this spreading of the micrococci is merely of secondary importance, *i.e.* concomitant with or subsequent to the spreading of the inflammation, or whether it is the primary cause as some assume, is not clear, and requires definite experimental proof.

In infantile diarrhœa the secretions of the bowels swarm with micrococci. In typhoid fever, clumps of micrococci may be found very extensively on the ulcerations of the bowels, and in the mucous membrane surrounding the ulcerations, and may be even traced into the mesenteric glands and the spleen.[1]

In dead tissues within the living body, such as occur after embolism, and in the case of various infectious maladies, micrococci may be found in colonies, *i.e.* as zooglœa, in the

FIG. 16.—CAPILLARY BLOOD-VESSELS OF NECROTIC MASSES FROM THE LIVER OF A MOUSE. THE CAPILLARIES ARE DISTENDED BY, AND FILLED WITH, ZOOGLŒA OF MICROCOCCI.

blood-vessels and in the parts around. The same holds good for the disseminated abscesses and necroses occurring in connexion with surgical pyæmia. In this malady masses of micrococci have been found in many of the affected organs.[2]

Wassilieff[3] has shown that these micrococci only occur after the death of the tissue or tissues, that in these they may

[1] Klein, *Reports of the Medical Officer*, 1876. Letzerich, Sokoloff, Fischel, &c.

[2] "Report of the Committee of the Pathological Society," *Pathol. Transactions*, vol. xxx.

[3] *Centralblatt f. d. med. Wiss.* No. 52, 1881.

multiply so as to form extensive colonies, and that therefore the presence of these micrococci is only a secondary phenomenon.

In pneumonia accompanying certain infectious maladies, *e.g.* typhoid fever, tuberculosis, and even in severe catarrhal pneumonia, large masses of micrococci may occur in the air-cells. In those cases where lobules and whole lobes become transformed into solid structures—grey hepatisation—masses of micrococci are found in the air-cells, and even growing into the blood-vessels in which stasis had set in. Such is the case in pleuro-pneumonia of cattle and in the pneumonia of swine fever. Pasteur has cultivated the micrococci in swine fever, and thought that he had reproduced the malady by inoculation. But this is not the case.

FIG. 17.—FROM A PREPARATION OF THE BLOOD OF A CHILD ILL WITH INFANTILE DIARRHŒA.
1. Blood-discs.
2. Dumb-bells of micrococci.

The micrococci, although very abundantly present in the bowels and in the body,[1] have nothing to do with the malady. Pasteur's inoculations with the cultivated micrococci are quite fallacious; his positive results are no doubt accounted for by accidental air-infection, for this malady is highly infectious, and unless the most rigorous precautions are taken to obviate infection through the air, positive results may be obtained which in reality are due to accidental air-infection.[2]

Micrococci occur always normally in large quantities in the fluids (saliva and mucus, &c.) of the nasal and oral cavities, pharynx, larynx, and trachea; they are derived no doubt from the atmosphere. On the papillæ filiformes of the tongue they form in some cases large masses.[3] Pasteur[4] has inoculated

[1] *Reports of the Medical Officer*, 1878, 1879.
[2] *Ibidem.*
[3] Butlin, "Fur of the Tongue," *Proceedings of the Royal Society*, 1880.
[4] *Comptes Rendus*, xlii.

rabbits with the saliva of a child that suffered from hydrophobia, and having cultivated artificially the micrococci present in this saliva, thought to have discovered that a micrococcus (*microbe spéciale*)[1] is the cause of hydrophobia. That saliva of the healthy dog and of man inoculated subcutaneously into rabbits sometimes produces death in these animals (Senator) had entirely escaped his notice, and Sternberg[2] has proved this in an extensive series of experiments. His own saliva proved sometimes fatal to rabbits. They die of what is called septicæmia, and Sternberg thinks it due to the micrococci; but this is not to be considered as proved.

All these micrococci stand therefore in no definite causal relation to the respective maladies, but are probably only of secondary importance.

The following micrococci are considered to stand in an intimate relation to specific diseases:—

1. *Micrococcus variolæ et vacciniæ.*—Chauveau[3] was the first to prove experimentally that in vaccinia and in variola the active principle is a particulate non-diffusible substance. Burdon Sanderson confirmed and extended this.[4] Cohn[5] proved that the lymph of vaccinia and variola contains numerous micrococci.[6] Weigert[7] showed for human small-pox, Klein[8] for sheep-pox, that the lymphatics of the skin in the region of the pock are filled with micrococci, and Pohl-Pincus[9] traced their passage through the epidermis at the point of vaccination in the calf. The micrococci are very minute, according to Cohn's estimate 0·0005 mm. and less in diameter, single or in dumb-bells, or in shorter or longer chains, or in small groups. When cultivated on the warm stage, they form very long chains and colonies. In connexion with this it must be mentioned, as stated on a former page, that similar micrococci occur also in the fluid contents of

[1] It is not quite clear whether this *microbe spéciale* is a dumb-bell micrococcus or a bacterium termo; it is quite possible that it is the latter, viz. a rod constricted in the middle. If so, it would appear identical with the bacterium that produces Davaine's septicæmia in rabbits (see Chapter viii.).

[2] Bulletin, April 30, 1881, National Board of Health, U.S.A.

[3] *Comptes Rendus*, 1868.

[4] *Reports on the Intimate Pathology of Contagion.*

[5] *Virchow's Archiv*, 1872.

[6] Keber, Hallier, Türn.

[7] *Mediz. Centralblatt*, 1871.

[8] *Phil. Transact.* 1874.

[9] *Vaccination*, Berlin, 1882.

vesicles in the skin produced by various non-infective inflammations. To make it sure that the micrococci are the active principle, *i.e.* the *causa morbi,* it would be necessary to artificially cultivate them through several generations, and then, by re-inoculating them, to reproduce the disease. This essential link in the evidence is, however, still wanting.[1]

FIG. 18.—MICROCOCCUS IN THE FRESH LYMPH OF HUMAN SMALL-POX.

1. Singly.
2. In dumb-bells.
3. In short chains.

FIG. 19.—LYMPHATIC VESSEL FROM THE SKIN OF A POCK IN SHEEP-POX.

The vessel is filled with micrococci.

2. *Micrococcus erysipelatosus.*—The micrococcus is very minute, smaller than that of vaccinia. Lukomsky[2] showed that, at the margin of an erysipelatous zone, that is the part where the disease is progressing and marked by the characteristic redness and swelling, the lymphatics of the skin are filled with zooglœa of micrococci, and the injection of these vessels keeps pace with the progress of the erysipelatous process. Orth[3] cultivated these micrococci artificially, and with such cultures produced by inoculation erysipelas in rabbits. Fehleisen[4] placed this beyond any doubt, inasmuch as he produced successive cultures of these micrococci (derived from the lymphatics of erysipelatous human skin), and then by re-inoculation produced the disease not only in rabbits but also in man. Fehleisen found the micrococci only in the lymphatics of the affected parts, and these he cultivated artificially for fourteen generations—which it took two months to do—on peptonised meat-extract gelatine, and solid serum. The micrococci form a whitish film on the top of the nourishing material, and when inoculated into the skin (ear) of rabbits, a

[1] See the prize announcement of the Grocers' Company, London, 1883.

[2] *Virch. Archiv*, vol. 60.

[3] *Archiv f. exp. Path.* Bd. i. 1874.

[4] *Die Aetiologie d. Erysipels*, Berlin, 1883.

characteristic erysipelatous rash makes its appearance after from thirty-six to forty-eight hours, and spreads to the root of the ear, and further on to the head and neck. The animals do not, however, die from it. In the human subject he produced typical erysipelas after inoculation with the pure cultivated micrococcus in fifteen to sixty hours. These inoculations were justifiable because they were undertaken with a view to cure certain tumours. Thus one case of lupus, one case of cancer, one case of sarcoma, were considerably affected, and to the good of the patient.

Fehleisen also in several instances carried out successfully a second inoculation within a few months. The same observer also found that a 3 per cent. solution of carbolic acid and a 1 per cent. solution of corrosive sublimate destroys the vitality of this micrococcus.

3. *Micrococcus diphtheriticus.*—Buhl, Hüter, and Oertel had shown that in diphtheria the membranes include micrococci. Oertel[1] found this micrococcus in large numbers, not only in the diphtheritic membranes of the organs of the throat and in their neighbourhood as well as in the surrounding lymphatics, but

Fig. 20.—Portion of a Diphtheritic Membrane.
Numerous micrococci present.

also in the blood of the general circulation, in the kidney, and in the muscles. The micrococci are about 0·00035–0·001 mm. in diameter, are slightly oval, occur singly or in dumb-bells, or in short chains; they form also continuous masses of zoogl\u0153a in the shape of spherical or cylindrical clumps, and as such they penetrate and destroy the surrounding connective and muscular tissues. In severe cases they are found blocking up the capillaries of the glomeruli and the uriniferous tubules of the kidney.

[1] "Experim. Unters. über Diphtherie," *Deutsches Archiv f. klin. Med.* Bd. viii. 1871.

Besides micrococci there occur in the diphtheritic membranes also other (rod-shaped) bacteria but these are evidently only accessory.[1] Cultivations and inoculations with pure cultivations of this micrococcus are still wanting.

4. *Micrococcus pneumoniæ.*—In acute croupous pneumonia there occur in the affected lungs large masses of micrococci; Klebs, Eberth, Koch, Leyden, and others have seen them, but Friedländer[2] first pointed out their constant occurrence. According to this observer they are oval, of a peculiar nail-like shape, about 0·001 mm. long, and occur in the sputum singly, but especially as dumb-bells or diplococci, as chains, and as zooglœa. Ziehl[3] found them in very large crowds in the sputum, giving to this in the early stages the peculiar characteristic brownish "prune-juice" tint. According to this observer they are very numerous only in the beginning of the illness; after the critical stage they decrease in numbers.

Griffini and Cambria saw the micrococci also in the blood. Salviali found that their number increases after the third day; on the ninth or tenth day they quite disappear.

G. Giles[4] found them in many cases of pneumonia (in India), both in the sputum and in the blood. Cultivations on boiled potato yielded good crops. These cultivated micrococci injected into the subcutaneous tissue of rabbits produced pneumonia.

Salviali and Zäslein[5] cultivated the micrococci (derived from the blood) in meat broth, meat-extract solution, &c., at 37°–39° C., and obtained good crops of them, with which they produced by inoculation in seven rabbits and six white rats typical pneumonia yielding the characteristic micrococci. These micrococci stain best in a mixture of Bismarck brown and methyl violet.

Quite recently Friedländer and Frobenius[6] cultivated the

[1] Compare also Klebs, *Archiv f. exp. Path.* iv.; Letzerich, *Virchow's Archiv*, vol. 68; Nassiloff, *ib.* vol. 50; Eberth, *Zur Kenntniss d. bact. Mycosen*, 1872; Wood and Formad, *Rep. of Nat. B. of Health, U.S.A.* 1882.

[2] *Virchow's Archiv*, vol. 87.

[3] *Centralb. f. med. Wiss.* No. 25, 1883.

[4] *Brit. Med. Journal.* July 7, 1883.

[5] *Centralb. f. med. Wiss.* No. 41, 1883.

[6] *Berichte d. physiolog. Gesellschaft in Berlin*, Nov. 9, 1883.

micrococci in gelatine mixtures, and obtained good crops. The micrococci were of the peculiar nail-like shape, and were characterised by a mucinous capsule. Inoculation with the cultivated micrococci into the lungs of dogs was followed occasionally by positive results; in rabbits no result was obtained, and in mice lobar croupous pneumonia and pleurisy invariably followed the inoculation twenty-four to forty-eight hours afterwards. In guinea-pigs the results were not so decisive. About half of the animals escaped, the others died with dyspnœa, the blood, lungs, and pleural exudations containing the same micrococci.

If the fluids containing these micrococci were heated to about 70° C. they became inefficacious; mice inoculated with them remained healthy. Such inefficient micrococci (*i.e.* first heated to about 70° C.) did not grow any more on gelatine. Friedländer and Frobenius found also that when mice, shut up in a chest, were compelled to breathe an atmosphere saturated by means of a spray with the micrococcus pneumoniæ, a number of them died from pneumonia and pleurisy, but not till the fourth or fifth day.

More recently[1] T. Poels and Dr. W. Nolen, in Rotterdam, assert that they have ascertained that in pleuro-pneumonia of cattle the pulmonary exudations contain micrococci, which in their morphology and mode of growth in artificial cultures are identical with the micrococci of human pneumonia. And they further assert that artificial cultures of the micrococci derived either from human pneumonia or from pleuro-pneumonia of cattle, produce in cattle the typical pleuro-pneumonia. Bruylants and Verriers[2] assert that they have successfully cultivated the micrococci of pleuro-pneumonia of cattle.

5. *Micrococcus gonorrhœæ.*—Micrococci have been found in the pus of gonorrhœa. Neisser,[3] and later Bokai and Finkelstein,[4] described them as spherical organisms of about 0·008 mm. diameter, generally forming dumb-bells, or sarcina-like colonies of four. Several such groups form a zooglœa. They

[1] *Centralb. f. d. med. Wiss.* No. 9, 1884.
[2] *Bull. de l'Acad. Belg.* 1880.
[3] *Centralb. f. d. med. Wiss.* No. 28, 1879.
[4] *Prager med. chir. Presse,* May 1880.

adhere to the pus-corpuscles and epithelial cells. They stain easily and well in methyl violet and gentian violet. Bockhart [1] has succeeded in artificially cultivating these micrococci, and in producing the disease by inoculation with the cultivated organisms.

FIG. 21.—TWO LARGE SCALY EPITHELIAL CELLS OF GONORRHŒAL PUS.
The epithelial cells are covered with micrococci, chiefly in dumb-bells, some in sarcina form.

Aufrecht [2] reports the case of an infant twelve days old who died with suppuration of the umbilical vein and liver. The liver cells and the interlobular tissue were crowded with micrococci (shown in sections by means of a 2 per cent. watery solution of Bismarck brown). These micrococci corresponded in size to the micrococcus gonorrhœæ, and he thinks it probable that they were derived from the vagina of the mother; during birth they might have got into the umbilical vein, there caused inflammation, and thence passed into the liver.

6. *Micrococcus endocarditicus.*—Micrococci in the form of zooglœa have been seen in *endocarditis ulcerosa.* They sometimes form plugs in the blood-vessels of the muscular tissue of the heart (Heiberg,[3] Maier,[4] Eberth,[5] Köster,[6] Klebs [7]). Heiberg saw the micrococci forming chains in the muscle of the heart, in the detritus of the ulcerations of the endocardium, in the plugs in the vessels of the spleen and kidney.

[1] *Sitzungsberichte der phys.-med. Gesellsch. in Würzburg*, Sept. 1882.
[2] *Centralb. f. d. med. Wiss.* No. 16, 1883.
[3] *Virchow's Archiv*, vol. 56. [4] *Ibid.* vol. 62. [5] *Ibid.* vol. 57.
[6] *Ibid.* vol. 72. [7] *Archiv f. exp. Path.* Bd. 9.

7. *Micrococcus scarlatinæ.*—In *scarlatina* Coze and Feltz[1] described micrococci as occurring in the blood; as I have mentioned above, I have seen them in the ulcerations of the throat,[2] and quite recently Pohl-Pincus[3] described very minute micrococci adhering to the scales of the desquamating epidermis in scarlatina. They form small colonies, and stain violet with a saturated solution of methyl violet. Their diameter is very small, only about 0·0005 mm. The same micrococci were noticed by Pohl-Pincus in the throat discharge.[4]

8. In the so-called *cattle plague* (or rinderpest) micrococci have been found in the lymphatic glands by Klebs (1872) and by Semmer in the blood and lympathic glands (1874 and 1881). In conjunction with Archangelski,[5] Semmer cultivated the micrococci, obtained from the lymphatic glands of a sheep dead of inoculated rinderpest, in beef broth, in meat-extract solution, and in mixture of broth, peptone, and gelatine at 37°–39° C. The micrococci grew very copiously as zooglœa and in chains. With these micrococci (of a first transfer or cultivation) a calf was inoculated, and died after seven days from rinderpest. The cultures when transferred lose gradually their virulence from one generation to the next, but animals (sheep) inoculated with these are protected against further virulent disease. Further, cultures exposed for an hour to a temperature of 46°–47° C. become greatly attenuated in their action, and sheep inoculated with virus thus attenuated are protected against virulent material. Temperatures of − 10° to − 20° annihilate the activity of rinderpest organisms. The specific nature of these micrococci of rinderpest cannot, however, be considered as well established as in the case of those mentioned above, *e.g.* micrococci of erysipelas, pneumonia, and gonorrhœa.

9. In *puerperal fever* micrococci have been found in the form of zooglœa by Heiberg,[6] in all affected organs—endocardium, lung, spleen, cornea, in a case of panophthalmitis puerperalis, and in

[1] *Malad. infect.* 1872.
[2] *Report of the Medical Officer of the Privy Council for* 1876.
[3] *Centralb. f. d. med. Wiss.* No. 36, 1883.
[4] Seen already by McKendrick, *British Med. Journal*, 1872.
[5] *Centralb. f. d. med. Wiss.* No. 18, 1883.
[6] Leipzig, 1873.

the kidney, forming casts of the uriniferous tubules and emboli in the blood-vessels. Laffler[1] found zooglœa and chains of micrococci in two cases of puerperal fever associated with brain-softening. In both cases emboli, due to micrococci, were found in the surroundings of the softened part of the brain. Emboli of micrococci were also here found in the vessels of the kidney.

10. In *pernicious anæmia* Frankenhäuser[2] described the occurrence of micrococci (?) in the blood of pregnant women suffering from this anæmia, not uncommon in Zürich. These micrococci were very large, about one-tenth of the broad diameter of a red blood-corpuscle, and some were provided with a flagellum (?). Some were divided in two. In the blood of the liver they occurred in large numbers. Frankenhäuser's description makes it very difficult exactly to understand what he saw. He also states that these micrococci were probably derived from decayed teeth, from which all his patients suffered.

Eppinger[3] described micrococci as occurring in *acute yellow atrophy* of the liver.

11. In the *syphilitic mucous patches* of several patients Aufrecht found a micrococcus, forming generally dumb-bells and staining very deeply in fuchsin.[4] Birch-Hirschfeld[5] confirmed this.

12. *Micrococcus of acute infectious osteomyelitis.*—Dr. Becker has made, in the laboratory of the Berlin Imperial Sanitary Office, a series of important experiments on the micro-organisms discovered by Schüller and Rosenbach. He collected pus from five cases of acute osteomyelitis in which the abscesses had not been opened, and cultivated the micrococci contained in it on sterilised potatoes, coagulated serum, and gelatine-peptone. In the latter case, the pus was introduced by means of needles into the mass, which was then kept at the temperature of the room during three to five days. After that time, the puncture made by the needles assumed the appearance of white streaks, around

[1] *Breslauer ärztl. Zeitschrift*, 1880.
[2] *Centralb. f. d. med. Wiss.* No. 4, 1883.
[3] *Prager Viertelj.* 1875.
[4] *Centralblatt f. d. med. Wiss.* No. 13, 1881.
[5] *Ibid.* No. 44, 1882.

which the gelatine liquefied gradually and took an orange-colour. After a few days more, the mass gave out a smell like sour paste, and the microscope revealed the presence of large numbers of micrococci, having the same appearance as those found in the pus. A small quantity of the mass was mixed with sterilised water and injected into the peritoneal cavity of some animals; they died in a very short time of acute peritonitis. The same fluid injected into the jugular vein caused acute septicæmia and death; but nothing abnormal was found in the bones in either case. Dr. Becker then injected a small quantity of the same fluid into the jugular vein of fifteen rabbits, after having, some days before, fractured or bruised the bone of one of the hind legs. On the day after the injection, weakness and loss of appetite were noticed; but after a short time the symptoms passed away, and the animals seemed to have recovered. At the end of the first week, however, a swelling formed at the seat of the bruise or fracture, the animal lost flesh, and died after a few days. On dissection, large abscesses were found around and in the bones, and in several cases metastatic abscesses had formed in the lungs and kidneys. Numerous colonies of micrococci were discovered in the blood and pus of the animals upon which the experiments were made. (*Brit. Med. Jour.*, March 29, 1884.)

13. Koch [1] described various kinds of micrococci intimately connected with certain destructive (pyæmic) processes in mice and rabbits. (*a*) Micrococcus of *progressive necrosis* in mice. Injecting into the ear of mice—white mice, or better, field mice—putrid fluids, he observed a necrosis of the tissues of the ear (skin, cartilage) starting from the point of inoculation and gradually spreading on to the surrounding parts and killing the animal in about three days. As far as the necrosis reaches, the tissue is crowded with micrococci, chiefly in the form of chains and zooglœa. The individual cells are spherical, of about 0·0005 mm. in diameter. I may mention that I have found a somewhat different micrococcus virulently active on mice. I have inoculated a number of white mice

[1] *Untersuchungen über die Aetiologie d. Wundinfections-Krankheiten*, Leipzig, 1878.

subcutaneously in the tail with a small micrococcus cultivated through several generations, and apparently derived from an artificial cultivation in pork broth, but due to accidental contamination. These micrococci, after having been cultivated in pork broth through several generations, were used in infinitesimal doses for the inoculation of the above mice. In two instances I have seen that the inoculation was followed after two to three days by purulent inflammation at the seat of inoculation, but apparently not spreading beyond it. But as time went on inflammation and abscess in the lungs set in and the animal died after about a week. On making longitudinal sections through the tail, it was found that in most of the lymph-spaces and lymph-vessels of all parts of the cutis and subcutaneous tissue, far away from the seat of inflammation, there were dense

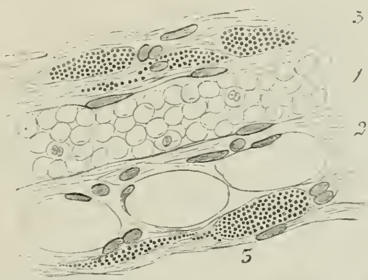

FIG. 22.—FROM A SECTION THROUGH THE TAIL OF A MOUSE INOCULATED INTO THE SUBCUTANEOUS TISSUE OF THE TAIL WITH ARTIFICIALLY CULTIVATED MICROCOCCUS.

The part here illustrated is a good distance from the ulceration.

1. A capillary blood-vessel filled with blood-corpuscles.
2. Fat cells.
3. Groups of micrococci filling the lymph-spaces of the connective tissue.

crowded masses of the same minute micrococci as were used for inoculation. And these crowds of micrococci could be traced to the seat of inflammation, where they extended amongst the inflammatory products in great masses. The abscesses in the lungs were filled with the same micrococci. Inoculated into the skin of fresh mice, it again produced death by pyæmia. This micrococcus may therefore be called the micrococcus pyæmiæ of mice. (*b*) Micrococcus causing *abscesses* in rabbits. Putrid blood injected into the subcutaneous tissue of the rabbit often produces suppurative abscess which, spreading, kills the animal in about twelve days. In the wall of the abscess are found

continuous masses of zooglœa of micrococci. The pus is infectious. The micrococci are spherical, and of a very minute size, measuring only about 0·00015 mm. in diameter. (*c*) Micrococcus causing *pyæmia* in rabbits. Skin of a mouse was macerated in distilled water for two days, and of this fluid a hypodermic syringe-full was injected under the skin of the back of a rabbit. After two days the animal began to lose flesh and died after 105 hours. Purulent infiltration spread from the seat of inoculation into the subcutaneous tissue; peritonitis; spleen much enlarged; slight pneumonia. A hypodermic syringe-full of the blood of this animal was injected under the skin of a second

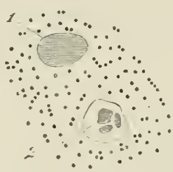

FIG. 23.—FROM A PYOGENIC MEMBRANE COVERING THE SEROUS COAT OF THE INTESTINE OF A RABBIT DEAD OF PYÆMIA.

1. A large oval nucleus, probably the nucleus of a detached endothelial cell.
2. A pus corpuscle.

The rest of the pyogenic membrane is beset with small micrococci.

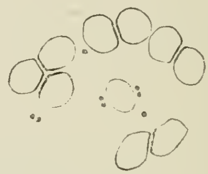

FIG. 24.—PYÆMIA OF RABBIT.

Blood of spleen. Between red blood-discs three dumb-bells and two single micrococci are shown. (Gentian violet staining.)

[The micrococci as here represented are somewhat too large.]

rabbit, and this died after forty hours. Post-mortem examination showed the same lesions as in the first case. In the blood-vessels of the affected parts were present micrococci, single, as dumb-bells, and in zooglœa; they were spherical, about 0·00025 mm. in diameter. (*d*) Micrococcus causing *septicæmia* in rabbits. An infusion of meat was prepared; this was left to putrefy, and of this fluid a quantity was injected under the skin of the back in two cases. Extensive gangrene with much œdematous exudation followed, and death ensued in two days and a half. The blood, the capillaries of the kidney, and the enlarged spleen, contained numerous oval micrococci. Two drops of the œdematous exudation-fluid were injected under the skin of the back of another rabbit. Death followed in twenty-two hours. There was no gangrene here; but œdema was present, spreading from the seat of the inoculation. Subserous hæmorrhages appeared in the intestines; and

minute hæmorrhages were also present in the œdematous tissue and in the muscles of the thigh and abdomen. The œdematous fluid, the cutaneous veins, the capillaries in the kidney, especially those of the glomeruli, in the lung, and in the spleen, contained numerous oval micrococci, singly, as dumb-bells, and in zooglœa.

FIG. 25.—OVAL MICROCOCCI FROM THE BLOOD-VESSEL OF THE SPLEEN OF A RABBIT, DEAD OF KOCH'S SEPTICÆMIA.

The micrococci measured about 0·0008 to 0·001 mm. in their long diameter. These micrococci (taken with the blood) produced in another rabbit and in a mouse the same fatal disease.

14. *Micrococcus bombycis* (Microzyma bombycis, Béchamp).—Oval micrococci, of about 0·0015 mm. in length, present in large numbers, singly and as dumb-bells and chains (straight or curved), in the contents of the alimentary canal and in the gastric fluid of silkworms dead of the "maladie de morts-blancs, *flacherie*." *Micrococcus ovatus*, Nosema bombycis.—Present in large numbers in the blood and organs, ova included, of silkworms affected with the disease called "maladie des corpuscles," "pébrine," or Cornalia's disease. Cornalia first saw them, afterwards Lebert and Nägeli. Pasteur proved definitely that ingestion as well as inoculation of the silkworms with the micrococci produces the disease. The micrococci are comparatively large, 0·003 to 0·004 mm. long, 0·002 mm. broad; they are very bright and occur singly, or in dumb-bells, or in small groups.

CHAPTER VIII.

BACTERIUM (*Microbacterium*, Cohn).

By this name Cohn[1] designates a class of minute schizomycetes, which are slightly elongated and oval, or short and cylindrical, with rounded ends. They divide by fission, like the micrococci, the individuals elongating and becoming constricted in the middle. They are capable of spontaneous locomotion, being possessed of a flagellum at one or both ends, with which they perform active spinning and darting movements. Bacteria are found also as dumb-bells, *i.e.*, in the act of dividing, and then appear as rods constricted in the middle. Occasionally, after rapid division, several remain connected, thereby forming a short chain. In this state the terminal elements are flagellate. Bacteria, like micrococci, are capable of forming zooglœa, the interstitial gelatinous substance being, as a rule, more copious than in the zooglœa of micrococci. In this state they form pellicles, in which the elements are without flagella; but from the margin of the pellicles one constantly sees elements separating, becoming flagellate, and moving away. In some species the zooglœa is dendritically ramified (*Zooglœa ramigera*, Itzigsohn), as seen on the surface of fluids containing decomposing algæ.

1. *Septic bacteria.*—With Cohn we distinguish two kinds:—*Bacterium termo* and *Bacterium lineola.*

(*a*) *Bacterium termo.*—The elements are short and cylindrical, about 0·0015 mm. long, a third less in breadth, and appear generally as dumb-bells. They are common in putrefying fluids, indeed they form the essential cause or ferment of decomposition, being the true saprogenous ferment (Cohn). They are invested in a thick membrane, and are flagellate. With the end of putrefaction they disappear. They grow well in Cohn's nourishing fluid, and I have found them as constant inhabitants of unfiltered distilled water in the laboratory; so much so that with a drop of this water I am always able to start a copious growth of bacterium termo in pork broth, Agar-Agar, &c. When

[1] *Biologie d. Pflanzen*, ii. (1872), p. 167.

cultivated in the incubator at 32° to 36° C. in suitable nourishing material (pork broth, chicken broth), they produce a uniform turbidity, and after several days an attempt at a pellicle, the

FIG. 26.—BACTERIUM TERMO FROM AN ARTIFICIAL CULTURE.

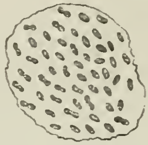

FIG. 27.—ZOOGLŒA OF BACTERIUM TERMO

whole nourishing fluid becoming thicker. But after from several days to a few weeks the cultures die, a fact which distinguishes them from all other bacteria. Growing in solid Agar-Agar and peptone mixture, they produce an imperfect liquefaction, numerous gas bubbles appearing in the material.

(*b*) *Bacterium lineola* (*Vibrio lineola,* Ehrenberg, Dujardin) differs from bacterium termo in being longer and thicker. The cells are about 0·003 to 0·005 mm. long, about 0·0015 mm.

FIG. 28.—BACTERIUM LINEOLA.

thick. They occur in well-water and stagnant water, where no distinct putrefaction is going on, and form zooglœa and pellicles on the surface of potatoes and various infusions.

2. *Zymogenic bacteria.* Two kinds are known :—*Bacterium lactis* and *Bacterium aceti.*

(*a*) *Bacterium lactis.*—According to Pasteur, these bacteria are

FIG. 29.—BACTERIUM LACTIS.

about 0·0015 to 0·003 mm. long, constricted in the centre; they form short chains, or even zooglœa, and they are motile. They

produce the lactic acid fermentation, in the course of which lactic sugar is transformed into lactic acid ; they are anaërobic. Lister,[1] by means of pure cultures, established experimentally their causal relation to the lactic fermentation or souring of milk.

(*b*) *Bacterium aceti* (*Mycoderma aceti*) is a little smaller than bacterium lactis, being about 0·0015 mm. in length, and often forms chains, and also pellicles, on the surface of the fluid ; it is motile. Pasteur maintains that it is the ferment of the acetic acid fermentation. Cohn [2] found it in enormous masses in beer that had become sour; it forms dumb-bells, seldom chains of four, and sometimes a pellicle on the surface. Pure cultivations have not been made with it, and before deciding whether it is the real cause of the acetic acid fermentation, experiments with such pure cultures, *i.e.* inoculations of alcoholic fluids with it, are required.

3. *Pigment bacteria.* Two kinds have been described :—*Bacterium xanthinum* and *Bacterium aeruginosum.*

(*a*) *Bacterium xanthinum* [3] is a bacterium, about 0·007 to 0·01 mm. long, motile, single, also in dumb-bells or short chains. It produces the yellow colour of yellow milk. Its pigment is soluble in water, and insoluble in alcohol or ether. When introduced into boiled milk of neutral reaction, it multiplies with great rapidity ; the milk coagulates after twenty-four hours ; it is soon teeming with them and turns yellow. The reaction of the yellow milk is at first acid, but soon becomes alkaline, and the alkalinity gradually increases.

(*b*) *Bacterium aeruginosum.*—In green pus Schroeter discovered a bacterium, *Bacterium aeruginosum.*[4] The pigment is greenish, and not lodged in the cells themselves; it is easily diffusible.

4. *Pathogenic bacteria.* Three kinds are described : the bacteria of Koch's septicæmia, of Davaine's septicæmia, and of fowl-cholera.

[1] *Pathological Soc. Transactions*, 1878.
[2] *Biol. d. Pflanzen*, ii. p. 173.
[3] Schroeter, *Biol. d. Pflanzen*, ii. p. 120 ; *Vibrio synxanthus*, Ehrenberg.
[4] *Loc. cit.* p. 122.

(*a*) *Bacterium septicæmiæ* (Koch).—By injecting into rabbits water from the rivulet Pauke, and from putrid mutton, Koch [1] succeeded in producing a rapidly fatal septicæmia, which was characterised by the following appearances:—The blood of all the organs contained very numerous bacteria, the spleen and lymphatic glands were enlarged, and the lungs congested; but there were no extravasations and no peritonitis. The smallest quantity of this blood inoculated into the skin or cornea of another rabbit produced after an incubation of ten to twelve hours distinct rise of temperature, and death after sixteen to twenty hours. The conditions after death were the same as above.

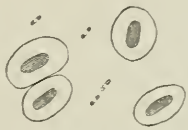

Fig. 30.—Blood of Pigeon, dead of Septicæmia. Four blood discs and four bacteria termo are shown

Everywhere the blood contained the bacteria. They are rods somewhat pointed at both ends, measuring about 0·0014 mm. in length and 0·0006 mm. in breadth. When stained they show at each end a deeply-tinted granule, the middle part remaining unstained; for this reason they are easily mistaken for a diplococcus. Generally these rods occur singly; occasionally they form a chain of two, or more than three.

They have been cultivated successfully in beef broth, blood serum, gelatine, and a mixture of gelatine and broth and peptone. The cultures have the same virulent properties as the original blood.

Mice, pigeons, fowls, and sparrows are also very susceptible to these bacteria; but guinea-pigs, dogs, and rats resist them successfully.

The microbe found by Pasteur in human saliva, which he cultivated, and with which he produced septicæmia in rabbits, may perhaps be a bacterium identical with the above, but this is not definitely settled.

(*b*) *Bacterium of Davaine's septicæmia.*—This is a bacterium

[1] *Mitth. aus d. k. Gesundh.* 1881.

which was originally derived by Davaine[1] from putrid ox-blood in the warm season. Injected into rabbits, it produced rapidly fatal septicæmia, of the same nature as in the case just mentioned, the blood teeming with a similar kind of bacterium as in Koch's septicæmia just described. The smallest quantity of the blood is again rapidly fatal in its action. It is distinguished from Koch's septicæmia in the rabbit by this, that

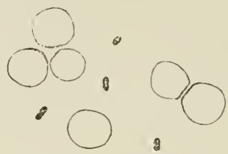

FIG. 31.—BLOOD OF RABBIT, DEAD OF DAVAINE'S SEPTICÆMIA.

Davaine's septicæmia is easily transmissible to guinea-pigs but not to birds.

Dowdeswell[2] has shown that when such blood is thoroughly sterilised (*i.e.* when the bacteria are killed), it has no longer any infective power. Davaine had first shown that the blood of rabbits dead of this form of septicæmia bears an enormous amount of dilution, without the minutest quantity of it losing its pathogenic properties. Dowdeswell has shown that this is easily explained by the enormous number of bacteria present in every drop of the blood. But it has been shown by Gaffky and Dowdeswell that there is no increase in the virulence of the virus when it is passed through successive animals, as was maintained by Coze and Feltz.[3]

(*c*) *Bacterium of fowl-cholera* (*microbe du choléra des poules*).—Semmer, Toussaint, and Pasteur[4] have shown that this organism is

[1] *Bull. d. l'Acad. de Méd.* 1872.

[2] *Proceedings of the Royal Society*, No. 221, 1882.

[3] Strasburg, 1866 ; Paris, 1872.

[4] I place this here as a bacterium, but it is not quite decided, and not quite clear from Pasteur's description, whether the microbe is only a micrococcus dumb-bell, or a bacterium termo. Compare also Semmer (*Vergleichende Pathologie*, 1878), Perroncito (*Archiv f. wiss. u. pract. Thierheilk.*, 1879). Toussaint (*Comptes Rendus*, xci. p. 301) considers the disease identical with Davaine's septicæmia. I am inclined to think that Pasteur has not used pure cultivations, but had the bacterium of fowl-cholera and an accidental micrococcus together. The latter would predominate as time passed on, so that after a few days it would far outnumber the bacterium ; and this is exactly what Pasteur's description suggests. He says that at first the microbe is rod-shaped, and after a few days it becomes a dumb-bell of micrococcus. The gradual attenuation by time of the virulence

present in large numbers in the blood and organs of fowls dead of this malady, which is chiefly characterised by the following symptoms :—The animals are somnolent, weak in their legs and wings, and they die under symptoms of extreme sopor. On post-mortem examination, hæmorrhage is found in the duodenum. The smallest quantity of the blood is infective. Pasteur successfully cultivated the bacteria in neutral chicken broth, at 25° to 35° C., and with it inoculated the fatal disease. The organism is probably a bacterium termo, very minute and slightly constricted in the middle, so that it appears of the shape of an 8. When cultures of this bacterium [1] are kept for some time (one, two, three or more months), their virulence becomes diminished or attenuated (owing, according to Pasteur, to the action of oxygen), and this diminution of virulence is in direct proportion to the time the culture is kept. The diminution or attenuation shows itself in this—that according to the length of time the culture is kept, the number of animals killed by its inoculation gradually diminishes, and it ultimately ceases to kill at all. Each culture of diminished virulence transmits its attenuation to the next following culture (?). It is possible to obtain cultures of such a low degree of virulence that when inoculated into the skin of a fowl only a local effect is produced, a peculiar infiltration; but the animal survives, and is then protected or "vaccinated" against the more virulent material. But in order to produce this protection, it is necessary that the culture (*vaccine*) should be of the proper strength. If it does not produce a local effect it gives no protection.

In fresh cultures the bacterium is more in the shape of a rod, constricted in the middle; in cultures several days old it looks very much more like a dumb-bell of micrococcus (see note on previous page).

Babes [2] has found the bacteria in the tissues and blood-vessels of animals dead of the disease, both inoculated and epizoötic, in the shape of rods of about 0·0015 to 0·002 mm. in length, and about 0·00025 mm. in thickness; the ends always staining more deeply than the middle part.

of Pasteur's cultures of the microbe of fowl-cholera may be due to the presence of this contaminating micrococcus.

[1] *Trans. of the International Med. Congress in London*, 1881, vol. i. p. 87.

[2] *Archives de Physiologie*, July 1883, p. 49.

CHAPTER IX.

BACILLUS (Dermobacterium, Cohn).

General Characters.—Bacilli are cylindrical or rod-shaped bacteria, which are rounded or square-cut at their extremities; they are longer in proportion to their thickness than bacterium termo, and divide by fission, forming straight, curved, or zigzag chains of two, four, six, or more elements. Many species of bacilli in suitable nourishing materials grow by repeated division into longer or shorter chains of bacillus—filaments or *leptothrix.* These appear straight or wavy and twisted, isolated or in bundles; and although in the fresh condition they appear of a homogeneous aspect, when suitably prepared, as by drying and staining with anilin dyes, they show themselves composed of shorter or longer cubical, cylindrical, or rod-shaped protoplasmic elements, contained in linear series within the general hyaline

FIG. 32.—BACILLUS SUBTILIS GROWN IN PORK BROTH.
At 1, the elements are thickened. The preparation had been dried and stained with anilin purple.

sheath: between many of the elements is a fine transverse septum. The isolated bacilli are likewise composed of a membrane and protoplasmic contents. These latter appear homogeneous or finely granular, and when stained with anilin absorb the dye very easily and retain it better and longer than the membrane. According to the stage and the rapidity of their

growth, the bacilli vary much in length; this is the case not only with the single bacilli and short chains, but also in an eminent degree with the elements of a bacillus-filament or leptothrix. In each case, indeed, it is possible to ascertain that all lengths occur from the cubical or spherical element to the cylinder or rod. The former elongate into the latter and then divide. According to whether division occurs in a short or long element, the daughter-elements are cubical or spherical in the former, cylindrical or rod-shaped in the latter case. This applies to single bacilli, to short chains, and to the leptothrix forms.

There are a great many species of bacilli, differing from one another (*a*) in the shape of the elements, (*b*) in motility, (*c*) in the power of forming filaments or leptothrix, and particularly (*d*) in the thickness and length of the elements.

(*a*) There are some species of bacilli, *e.g.* hay-bacillus, anthrax-bacillus, bacillus of putrid blood, bacillus found occasionally in the blood-vessels of dead animals, bacillus of malignant œdema (Koch), &c., in which in the single bacilli and in the chains and filaments, the size of the elements varies from that of a cubical or spherical mass of protoplasm to that of a cylinder or rod several times as long as it is thick. In some species (*e.g.* tubercle-bacilli), the elements are almost spherical. There are on the other hand other species (*e.g.* bacillus amylobacter) where the elements are always rods or cylinders. In these cases of short bacilli it sometimes becomes difficult to say whether one has to deal with bacilli or bacteria, but the growth of the bacilli into leptothrix, and particularly their power of forming spores, is decisive, although neither of these events may happen, owing to peculiar conditions.

(*b*) Some bacilli (*e.g.* hay-bacillus, bacillus in common putrefaction, bacillus growing on surfaces of putrefying material and tissues, bacillus found in the abdominal organs after putrefaction has set in, &c.), are possessed of a flagellum at one end, and are therefore endowed with the power of locomotion. Other species (*e.g.* anthrax-bacillus, bacillus of malignant œdema) are without such power. But even in the first case the power of locomotion is possessed by the bacilli only when single or in short chains, not by the longer chains or leptothrix.

(*c*) Not all bacilli are capable of forming leptothrix-filaments.

This power is possessed in an eminent degree by certain species, such as the hay-bacillus, the anthrax-bacillus, the bacillus of malignant œdema, the bacillus found on the surface of the mucous membrane lining the cavity of the mouth and tongue (leptothrix buccalis). Other bacilli (*e.g.* bacillus amylobacter, leprosy-bacillus, tubercle-bacillus, &c.), generally do not form leptothrix.

(*d*) There exists the greatest variety in reference to the thickness of the bacilli; some (*e.g.* bacillus amylobacter, and some species occurring in ordinary putrefaction) being several times as thick as others like hay-bacillus, anthrax-bacillus, &c.

Many bacilli and bacillus-filaments (*e.g.* hay-bacillus, anthrax-bacillus) degenerate on growing old, the protoplasmic elements becoming granular and breaking down altogether into debris. This may occur to single elements within a chain or leptothrix; and then the corresponding part of the sheath of the chain, owing to the subsequent disappearance of the debris, becomes empty and devoid of protoplasm. Longer or shorter portions of a chain or leptothrix may thus degenerate and become deprived of protoplasm, the sheath only persisting. These portions become at the same time thicker, the sheath having swollen up.

Another mode of degeneration consists in the elements and sheath curling up, swelling up, and ultimately breaking down into debris. According to Cohn,[1] bacilli do not form zooglœa in the same way as micrococcus and bacterium do. With all due deference to the authority of Cohn, I must hold that the bacilli possessed of a flagellum are capable of forming a true zooglœa. When one inoculates a fluid nourishing medium (*e.g.* broth) with hay-bacillus or other motile bacillus of common putrefaction, after keeping it for twenty-four hours in the incubator one notices a uniform turbidity. After several days one notices that the surface of the fluid becomes covered with a whitish film; this as incubation goes on thickens into a thick resistent not very friable pellicle. By shaking the tube the pellicle becomes detached from the glass wall and sinks to the bottom of the fluid; after another day or two a new pellicle is formed, and so on until the material is exhausted.

[1] *Beitr. z. Biologie d. Pflanzen*, vol. ii.

Any part of this pellicle examined under the microscope shows itself to be a zooglœa in the true sense of the word, vast numbers of shorter or longer bacilli crossing and interlacing and lying embedded in a gelatinous hyaline matrix. As with bacterium termo, one occasionally notices at the margin of the mass one or other bacillus wriggling itself free and darting away. And in the case of non-motile bacilli, putrefactive and others, I have also seen distinct formations of zooglœa, having the shape of spherical or oval lumps of various sizes composed of a hyaline jelly-like matrix, in which are embedded the bacilli in active multiplication.

In those species in which the bacilli are capable of forming leptothrix (leptothrix buccalis, hay-bacillus, anthrax-bacillus) the filaments may form dense convolutions. When in these convoluted filaments spores are formed (see below) and the sheaths of the filaments swell up and become agglutinated into a hyaline jelly-like substance, the spores appear to form a sort of zooglœa.

Bacilli are killed by drying, but it is necessary to bear in mind that they must be exposed to the drying process in thin layers (Koch). At the temperature of boiling water they are invariably killed, but not their spores. Even heating them from half-an-hour to several hours at a temperature above 55° or 60° C. kills them. Freezing also kills them, but not their spores. Carbolic acid, corrosive sublimate, thymol, &c., kill them.

One of the most striking phenomena in the growth of bacilli is their power of forming spores. These are generally oval when fully developed, spherical when immature; they are always of a bright glistening appearance, and take dyes either with difficulty or not at all; they are generally a little thicker than the bacilli within which they have developed. Their formation always takes place in this way: in one or other elementary cubical, spherical, or rod-like mass of protoplasm there appears a bright dot; this enlarges at the expense of the protoplasm until in its fully developed state it has an oval shape. The whole of the protoplasm of an element is not consumed in this process, a small trace always remaining unused at one or both ends. The sheath enlarges, and the bacillus looks much thickened; then the sheath breaks, and the spore with the remnant of protoplasm

becomes free. Soon this remnant disappears, if it had not disappeared while the spore was still contained within the sheath, and now the spore is free. Under the most favourable conditions a spore may be formed in each elementary mass of protoplasm, or it may be only in a small number. In the first case:

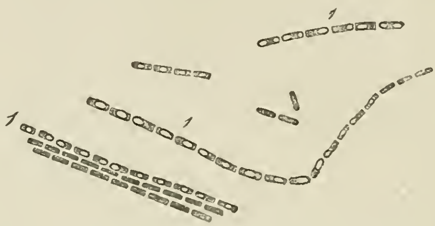

FIG. 33. THE SAME BACILLUS AS IN PRECEDING FIGURE.
At 1, spores have made their appearance.

a consecutive series of spores is present in the bacilli, two spores if the bacillus is composed of two elementary cells, four in a chain of four elementary cells, or a vast number in a leptothrix. In the second case: a bacillus composed of two or four elementary cells may contain only one spore at one end or in the middle, or one at each end, or two together in the middle; in the leptothrix

FIG. 34.—THE SAME BACILLUS AS IN PRECEDING FIGURE.
Some of the spores are germinating into bacilli.

FIG. 35.—BACILLUS SUBTILIS OF HAY INFUSION.
At 1, spores are germinating into bacilli.

spores are seen only at comparatively long intervals. The position of the spore in the bacillus is generally so that the long axis of the spore is parallel to that of the bacillus; but exceptionally it may be placed obliquely or even transversely. The bacilli in which spore-formation has set in are always much thicker, twice or more, than those in which no spore formation has occurred; and as has been stated above the sheath swells up and remains for some time as a hyaline gelatinous capsule around the spore,

but sooner or later this is also lost and the spore becomes quite free. When spore-formation has taken place in a convolution or in a mass of leptothrix, and after the sheaths of the bacilli have become swollen up into a gelatinous matrix, it looks as if we had a zooglœa, in which the bright oval spores form the particular elements embedded in a more or less hyaline gelatinous matrix. But even in these cases on careful analysis it is noticed that the spores have a linear or serial arrangement, being originally developed in filaments.

This spore-formation occurs in all species of bacilli, and it closes the cycle of the life-history of the bacilli. But it does not take place under all circumstances. In the case of many bacilli, *e.g.* hay-bacillus, anthrax-bacillus, bacillus of putrefaction, spore-formation occurs only when there is an ample supply of oxygen, *e.g.* when the bacilli grow on the surface of the nourishing material (Cohn, Koch). It has nothing whatever to do with the exhaustion of the nourishing material, as Buchner seems to think; for if the conditions of spore-formation are given, amongst these particularly the exposure to the air, bacilli will commence to form spores long before the nourishing material is exhausted. I will here mention a particular instance to show this.

Take a test-tube with Agar-Agar peptone, such as has been mentioned in a former chapter as fit for inoculation; inoculate the surface of the Agar-Agar with hay-bacillus or anthrax-bacillus, place it in the incubator, and keep it there at a temperature of 30° to 35° C. After 36 to 48 hours you will find the surface covered with a good crop of bacilli and leptothrix, and in some of them spore-formation is already going on with great vigour. For several days after, the amount of leptothrix increases, and in the filaments large numbers of spores are formed. This goes on for several weeks, long before the nourishing material becomes exhausted. But during all this time the spore-formation is limited only to the surface; the filaments growing into the deeper strata remain without spore-formation. The same observation can be made with gelatine mixtures of peptone, broth, &c., in the test-tube or in the glass cell described and figured in Chapter V. In the case of the gelatine mixture it is particularly instructive to watch this

process, since it clearly proves that the free access of air is essential for the formation of spores. For if the anthrax-bacillus be grown on the (solid) mixture of gelatine and broth described in a former chapter and kept at the ordinary temperature of the room or in the incubator at not more than 22° to 25° C., the spore-formation on the surface occurs only as long as the material remains solid. Anthrax-bacillus as it grows liquefies the gelatine mixture; in consequence of this after some days the superficial layers of the material become fluid, and the bacillar growth, sinking to the bottom of the fluid layer, is thus removed from the surface. The spores which were freely formed while the growth went on on the surface, germinate again into bacilli, but because these have now sunk into the depth, although rapidly multiplying and growing into filaments, they cease to form any spores.[1]

Bacilli which are not possessed of the power of locomotion (*i.e.* are without a flagellum) when sown into the depth of a fluid or solid material, if they have no chance, accidental or otherwise, of reaching the surface, do not as a rule form spores; but there are some such bacilli which, although not growing on a free surface, nevertheless form spores, *e.g.* the bacillus butyricus or amylobacter (Prazmowski). Some putrefactive bacilli occurring in the abdominal organs (intestinal wall, kidney, spleen, liver), and in fluid exudations within the peritoneal and pleural cavities, show also spore-formation; probably they get their oxygen from the tissues. Anthrax-bacillus, however, never forms spores except it is growing well exposed to the outer air.

The bacilli which are possessed of a flagellum (*e.g.* hay-bacillus, bacillus of putrefaction) generally form a pellicle on the surface and in this pellicle copious spore-formation goes on.

The spores first formed, when shaken down into the fluid, again germinate into bacilli, and there multiply. The last pellicle formed in a culture, before exhaustion, represents the last crop of spores; and these, owing to the exhaustion of the nourishing fluid, remain as spores, only capable of germinating into bacilli when new nourishing material is added, or when they are transplanted to new nourishing material.

It is a rule that wherever the spores are formed they ger-

[1] *Report of the Medical Officer of the Local Government Board*, 1881.

minate into bacilli if they have access to nourishing material; but if not, or if the nourishing material is exhausted, they remain as spores. Spore-formation does not take place at low temperatures. Koch found in the case of anthrax-bacillus that a temperature below 12° C. prevents the formation of spores. Pasteur states that in the case of anthrax-bacillus spore-formation does not take place above 40° C.; never for instance at 42° or 43° C. Koch gives 43° as the upper limit; but I have found that both in the case of hay-bacillus and anthrax-bacillus the bacilli form spores copiously even at a temperature of 44° C. Moisture is an essential element in the formation of spores.

The spores represent the seeds capable of retaining life and of germinating into bacilli even after what would appear the most damaging influences (that is, damaging to all other kinds of organisms and to the bacilli themselves), such as long lapse of time, drying, heat, cold, chemical reagents, &c. Spores retain the power to germinate into bacilli after the lapse of long periods, and there is no reason to assume that these periods have any limit; it makes no difference whether they are kept dry or in the mother-liquid.

The temperature of boiling water, while it kills micrococci, bacteria, and bacilli themselves, does not affect the vitality of the spores. Cohn (*loc. cit.*) found spores of hay-bacillus still capable of germination even after boiling; boiling for half an hour or more killed them. Prazmowski found that the spores of bacillus butyricus (amylobacter) are killed by five minutes' boiling. In the case of anthrax-bacillus and hay-bacillus I found that boiling for half an hour does invariably kill them, but ten minutes is not to be relied on. Exposing the spores of anthrax-bacillus to a temperature of 0° to –15° C. for one hour did not kill them. Antiseptics, such as carbolic acid (5-10 per cent.), strong solutions of phenyl-propionic acid and phenyl-acetic acid, corrosive sublimate (1 : 300,000, Koch), although the spores were kept in these fluids for twenty-four hours, did not kill them.

Pure terebene, phenol (10 per cent.), corrosive sublimate (1 per cent.), does not kill the spores of bacillus anthracis.

This great resistance of spores to low and high temperatures, to acids and other substances, is due to this, that the substance of each spore is enveloped in a double sheath: an internal

sheath probably of a fatty nature, and an external one probably of cellulose; both are very bad conductors of heat.

Owing to the fact that spores resist the action of boiling water, if not prolonged for ten minutes, and that the other bacteria (such as micrococcus, bacterium, and bacillus itself) are killed by the temperature of boiling water if kept at this temperature for a few seconds, it is possible to separate the spores of bacilli from the other organisms. All one has to do is to subject the fluid containing these various organisms to the temperature of boiling water for a few seconds. All except the spores of bacilli will be thereby killed, and thus the fluid becomes free of all other organisms except the spores.

When spores are sown in a nourishing material, fluid or solid, and when this is exposed to a temperature of about 32° to 38° C., the spores after the lapse of a few hours, in some cases six (spores of anthrax-bacillus), in others two to four hours (spores of hay-bacillus), in others more than six hours, are seen to germinate, each spore growing into a bacillus. In the case of solid nourishing material the presence of moisture is essential.

In this germination what one sees is this: the spore increases in thickness, it then loses its dark contour at one pole or at one of the long sides, and at this point a pale projection appears. This projection increases in length and gradually becomes as long as a bacillus, the investment of the spore gradually fading away. This new bacillus soon divides into two, and so on.

The spores are capable of germinating independently of the free access of air.

(*To be continued.*)

ON THE ACTION AND USE OF DIURETICS.

BY T. LAUDER BRUNTON, M.D., F.R.S.

(*Continued from* p. 282.)

Circumstances modifying the Secretion of Urine.—The experiments of Ludwig and his pupils have shown that the amount of urine secreted depends very closely upon the pressure of blood in the malpighian corpuscles, or, to put it more exactly, on the difference of pressure between the blood in these corpuscles and the pressure within the tubules. For if the ureter be tied so that the pressure of urine in the tubules is increased, the secretion is greatly diminished, and even arrested, even though the pressure of blood in the renal artery be high.

A somewhat similar effect to that of ligature of the ureter is produced by ligature of the renal vein, for the blood accumulating in the venous plexus surrounding the tubules compresses them so as to prevent the flow of urine through them. A similar condition may occur from cardiac or pulmonary disease obstructing the venous circulation.

But unless in exceptional circumstances which alter the pressure within the tubules, such as compression of the tubules by congestion of the venous plexus, as in cardiac disease, impaction of a calculus in the ureter, or pressure on the ureters by dropsical accumulations or tumours, the rapidity of the secretion of urine depends on two factors:—(1) arterial pressure in the glomeruli; and (2) the composition of the blood.

The pressure of blood in the glomeruli may be raised—

(1) by increase of the arterial tension generally,

(2) by increased tension locally.

Thus the effect of cold wind and cold baths is probably due chiefly to their power of contracting the vessels in other parts of the body, and thus driving more blood into the renal artery, and increasing the pressure in the glomeruli. In some pathological conditions also we find the blood pressure high, and the secretion of urine abundant. This occurs, as a general rule, in persons suffering from cirrhotic or contracting kidney, in whom the pulse is generally tense, and the blood pressure high, although in these cases also the high blood pressure is probably not the only factor in the increased secretion.

Such a general increase may be brought about by greater action of the heart, or by contraction of the blood vessels in other vascular areas, such as the intestines, muscles, or skin, by nervous stimulation, exposure to cold, or the action of drugs.

The pressure may be increased locally by dilatation of the renal arteries, *e.g.* from section of the vaso-motor nerves, or possibly stimulation of vaso-dilating nerves.

In addition to such increase of pressure in the glomeruli by increase of blood supply to them, we must not, however, forget the possibility of increased pressure in them by contraction of the efferent vessels leading from them, as well as of those arterial twigs (arteriæ rectæ) which pass directly to the venous plexus surrounding the tubules, and which form no inconsiderable part of the vascular supply of the kidney.

Alteration in the size of the renal vessels were formerly ascertained simply by exposing the kidney and observing its colour, contraction of the arteries being associated with paleness, and dilatation with redness of the organ. A much more exact method has been introduced by Roy, who incloses the kidney in a capsule filled with oil and connected with a registering apparatus. When the vessels dilate, the kidney increases in size, and diminishes when it contracts, so that the alterations can be readily recorded on the same revolving cylinder on which the general blood pressure is registered by the manometer.

The pressure of blood in the glomeruli may be diminished generally—

(1) by failure of the heart's action, or

(2) by dilatation of vessels in larger areas, as the intestines, muscles, and skin.

The pressure of blood in the glomeruli may be diminished locally by contraction of the renal arteries, or of the afferent branches to the glomeruli.

The heart's action may fail from many causes, which have already been discussed more particularly.

Dilatation of the vessels in the skin, intestines, &c., may be caused by exposure to warmth, by the action of drugs, or by paralysis due to nervous injury.

Section of the splanchnics or of the spinal cord causes paralysis of the renal arteries, and ought, therefore, to increase the secretion of urine. This does occur, though not invariably, when the splanchnics are divided; but section of the spinal cord, by paralysing the intestinal and other vessels, lowers the blood pressure so much that the supply of blood to the kidney is not only much below the normal, but is so small that the secretion of urine is generally almost completely arrested.

The nerves of the kidney consist of a number of small branches running along the renal artery and containing a number of ganglia. When these nerves are cut the vessels of the kidney dilate; when they are stimulated the vessels contract. A number of these fibres pass to the kidney from the spinal cord through the splanchnics, so that when the splanchnics are cut the vessels of the kidney usually dilate, and when they are irritated, they contract.

The whole of the nerves, however, do not pass through the splanchnics, for stimulation of a sensory nerve, of the medulla oblongata, or of the spinal cord in the neck will cause contraction of the renal vessels after both splanchnics have been cut, and section of the splanchnics does not always cause the renal vessels to dilate.

The nervous centre for the renal arteries is probably, like the chief vaso-motor centre for the body generally, in the medulla oblongata; but in all probability there are also subsidiary centres in the spinal cord and in the solar and mesenteric plexuses.

The reason for supposing these latter centres to exist is, that stimulation of the peripheral end of the splanchnic, divided at its passage through the diaphragm, causes contraction of both kidneys, and the vessels of the kidney of the side opposite to

the stimulated nerve commence to contract later than that on the same side. A delay like this in the action of the stimulus means that it has not acted directly, but through the medium of ganglia.

When the splanchnics are divided, the vessels of the kidney sometimes dilate and the kidney increases in size; a profuse secretion of urine may take place, which quickly increases to a maximum and remains for a considerable time. This, however, is not a constant effect, and not infrequently the vessels do not dilate, and the kidney, instead of increasing, diminishes in size. This is what to a certain extent might be expected, inasmuch as a section of the splanchnics causes dilatation of the intestinal vessels and lowers the blood pressure, and thus diminishes the supply of blood to the kidney.

When a puncture is made in the medulla oblongata in the floor of the fourth ventricle, profuse secretion also occurs, but this differs from that caused by section of the splanchnics, in being preceded by slight diminution, in rising rapidly to a maximum, and then rapidly falling. These characters seem to show that it is due to irritation of some vaso-dilating mechanism [1] rather than to any paralysis.

Stimulation of the vaso-motor centre in the medulla oblongata by venous blood, or by drugs such as strychnine or digitalis has a twofold action on the kidney, for it tends to cause contraction not only in the vessels of the kidney, but in those of other parts of the body. The effect on the kidney is thus a complicated one, for the contraction of the intestinal and other vessels by raising the blood pressure tends to drive blood into the kidneys at the same time that the contraction of the renal arteries tends to keep it out. When the renal nerves are cut, the renal vessels no longer oppose the entrance of blood, and therefore the renal vessels dilate very greatly when the vaso-motor centre is stimulated; but when the renal nerves are intact the result is a varying one, for sometimes contraction of the renal vessels may be so great as to prevent the entrance of blood into the kidney, however high the general blood pressure may rise; at other times the general high blood pressure may be able to dilate the renal arteries in spite of any resistance they

[1] Heidenhain, *Hermann's Handbuch d. Physiologie*, vol. v. Th. 1, p. 366.

may offer. These different conditions may occur subsequently to one another; and this stimulation of the vaso-motor centre may cause contraction of the renal vessels succeeded by dilatation, or *vice versâ.* Thus Mr. Power and I found that on injecting digitalis into the circulation of a dog the blood pressure rose, but the secretion of urine was either greatly diminished or ceased altogether. Here it is evident that the renal vessels had contracted so much as to prevent the circulation through the kidney, notwithstanding the rise which had taken place in the blood pressure. After a while the blood pressure began to fall, and then the secretion of urine rose much above its normal, showing that the general blood pressure was then able again to drive the blood into the kidneys.[1]

Similar observations were made by Mr. Pye and myself with regard to erythrophleum, and the accompanying curves show

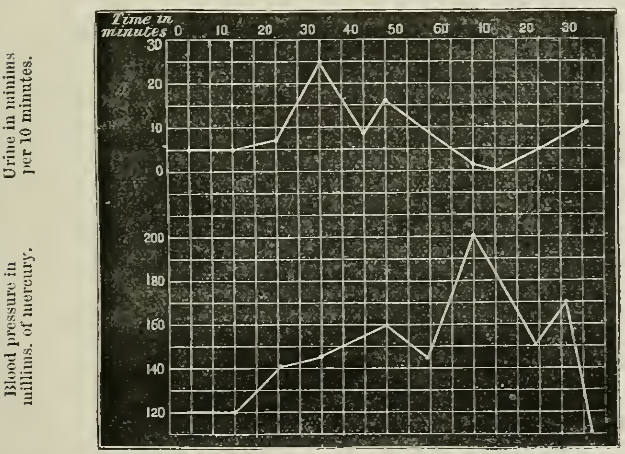

FIG 5.—Curves showing the effect of erythrophleum upon the blood pressure and secretion of urine. From *Phil. Trans.* vol. 167.

well the result upon the urine of the mutual action of the rise in blood pressure and the contraction of the renal arteries upon the secretion of urine. It will be noticed that at first the blood pressure rises more quickly than the secretion of urine, the circulation through the kidney appearing to be opposed by the renal arteries. This opposition is then overcome, and the

[1] *Royal Society's Proceedings*, No. 153, 1874.

secretion of the urine rises more quickly than the general blood pressure. The renal vessels again appear to contract, so that the urine diminishes while the blood pressure rises still further. We have then oscillations due first to one factor and then to the other being predominant; and then, when the blood pressure rises to its maximum, we find that the urine is at its minimum, the secretion of urine again rising as the blood pressure falls.

A good deal of discussion has arisen regarding the mode of action of digitalis, and it has been stated by many to act as a diuretic only in cases of heart disease, and to have no diuretic action in health. In my own experiments, however, I found that it acted as a very marked diuretic even in health, and the explanation of this discrepancy may possibly be that, in my own case, the blood pressure was low, whereas in the others it was probably much higher; but I am uncertain regarding the true explanation, though I am certain of the fact.

By causing increased secretion of water through the kidneys diuretics may increase the concentration of the blood and thus produce thirst, or cause absorption of water from the intercellular tissue or serous cavities in dropsies. In my own experiments on digitalis I weighed all my food and measured all my drink for nearly six months, taking exactly the same quantity every day. After producing profuse diuresis by a large dose of digitaline (sixty milligrammes in two days), such thirst ensued that I was forced to take a quantity of water to allay it.[1]

Mode of Action of Diuretics.—From what has already been said, it is evident that diuretics may act in several ways. They may act: (A) on the circulation in the kidney, raising the pressure in the glomeruli, (1) *locally* (*a*) by contracting the efferent vessels, or the arterial twigs which pass directly to the capillary plexus ; (*b*) by causing dilatation of the renal arteries, and thus increasing the supply of blood to the kidney. This they may do also in more ways than one, for they may either paralyse the vaso-motor nerves of the kidney, or act on vaso-dilating mechanisms. (2) they may raise the blood pressure *generally* by causing the contraction of vessels in other parts of the body. (B) other diuretics may act on the secreting cells of

[1] The experiments were made in 1865 and published in part in my thesis on *Digitalis, with some Observations on Urine.* London : Churchill and Co. 1868.

the tubules, and may increase both the amount of water and the amount of solids excreted by them.

Diuretics have been by some classified as stimulating and sedative; and the sedative class agrees very closely with the one which we have just indicated as acting on the kidney through the circulation.

From what has been said of the action of diuretics it is evident that we may hope to do much more by combining them, than by using them singly. Thus we see that digitalis, instead of acting as a diuretic, may completely arrest the renal circulation, and stop the secretion altogether. If however, we can combine it with something which will produce dilatation of the renal vessels, while the general blood pressure remains high, we shall greatly increase the circulation through the kidney, and obtain the desired result. Experiments in regard to this were made by Grutzner with nitrite of sodium. He found that this substance increased the secretion of urine when the blood pressure was reduced to a minimum by curara; and he found that it also had this effect when the blood pressure was raised by imperfect respiration. When the vaso-motor centre was greatly stimulated however, by allowing the blood to become very venous, the nitrite of sodium no longer produced any increase of secretion.

All nitrites have an action on the blood-vessels more or less alike. All of them cause the arterioles to dilate either by an action on their muscular walls or on the peripheral terminations of vaso-motor nerves. One of the commonest diuretics is spiritus ætheris nitrosi which contains nitrite of ethyl. Sometimes this is combined with acetate of ammonia as a diaphoretic, sometimes with digitalis, broom, or spirit of juniper as a diuretic. We have already seen that the action of the skin and of the kidneys are complementary, so that if we increase the secretion from the one we tend to diminish that of the other. At first sight then it might appear curious that we should use the same drug to increase the secretion of both. Yet there can be little doubt from clinical experience that nitrous ether is useful for both purposes, and the reason of its utility at once becomes evident when we remember that its action is strictly neither diaphoretic nor diuretic, but simply that of dilating the vessels and consequently allowing the blood to flow freely in whatever

direction it may be determined by other conditions. If by combining it with digitalis we can dilate the renal arteries while those of the other parts of the body remain contracted, it is evident that we shall obtain a much freer flow of urine than we could by the administration of digitalis alone.

If instead of a diuretic like digitalis, which acts chiefly through the blood-vessels, we combine spirits of nitrous ether with salts of potassium, which act on the secreting structure, it is evident that we are likely to obtain from the increased circulation in the kidneys caused by the nitrites a much more plentiful secretion than the potassium salts alone would have produced.

The mode of action of diuretics may perhaps be rendered clearer by the following table. At present the data we possess are insufficient to allow us to classify diuretics with absolute certainty according to their mode of action, yet I think the accompanying table may be fairly said to represent our present knowledge of the subject, its imperfections being indicated by the number of notes of interrogation which the table contains:—

TABLE SHOWING THE PROBABLE MODE OF ACTION OF DIURETICS.

DIURETICS	Raise arterial pressure......	Generally ...	Increased action of the heart by alcohol. Contraction of vessels in intestine and throughout the body.		Digitalis. Erythrophleum. Strophanthus. Squill. Convallaria. Strychnia. Cold to surface.
		Locally in kidney ...	Contract efferent vessels or arteria recta so as to raise pressure in glomerulus and lessen absorption in tubules, or both.	By action on vaso-motor centres.	? The same as in preceding list.
				By local action on vessels or nervous structures in the kidney itself.	? Broom. ? Turpentine. ? Juniper. ? Copaiba. ? Cantharides.
			Dilate afferent vessels.	Paralyse vaso-motor nerves or involuntary muscular fibre. Stimulate vaso-dilating nerves	Nitrites. Alcohol. ? Urea.*
	Act on the secreting nerves or secreting cells of the kidney itself.	Increase water excreted.	Urea. Caffeine.		
		Increase solids excreted.	Liquor potassæ. Potassium acetate, &c.		

* When a current of blood is passed artificially through an excised kidney, the stream is much accelerated by the addition of urea. Abeles, *Sitz-Ber. d. k. k. Wiener Akad.* Bd. 87, Abt. 3, April, 1883.

It not infrequently happens that one is able to understand a hypothesis more clearly when it is put in a diagrammatic form, and that one can thus perceive more readily the particular points in which it may be erroneous, even if true in the main. I therefore subjoin a diagram of the circulation and secreting

apparatus of the kidney to show the parts which are probably affected by different diuretics:—

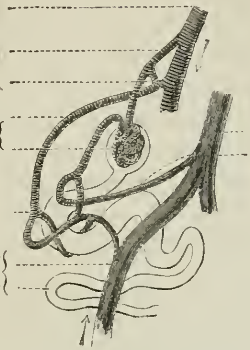

FIG. 6.—Diagram to show the parts of the secreting apparatus of the kidney which are probably affected by different diuretics.

Uses.—Diuretics may be employed either for the purpose of removing water or solids from the body. They are used:

1st, to remove the excess of fluid met with in the tissues and serous cavities in cases of dropsy.

2nd, to hasten the removal of injurious waste products and poisonous substances from the blood.

3rd, to dilute the urine.

In cases where the accumulation of fluid depends on venous congestion, as for example in cardiac dropsy, those diuretics which act on the general vascular system, like digitalis, strophanthus, squill, or erythrophleum, are most efficient because they tend to remove the cause of the dropsy, as well as to assist the absorption and excretion of the fluid already effused.

When the dropsy depends on the disease of the kidneys or liver, other diuretics should either be given instead of, or along with, digitalis or squill, even in cases of cardiac disease. Where digitalis or squill are not proving efficacious, the addition of a little blue pill greatly assists their action, though it would be hard to say in what way it does so.

In dropsy depending on kidney disease, decoction of broom, and oil of juniper, and nitrous ether, are amongst the most reliable diuretics, and copaiba in hepatic dropsy.

Diuretics are used to increase the secretion of solids in febrile

conditions, and in cases of kidney disease where the excretion of waste products is deficient, and their retention threatens to prove injurious. In such cases, nitrate and bi-tartrate of potassium, turpentine, and juniper, and caffeine are useful.

Diuretics are also used to increase the proportion of water in the urine, and thus to prevent the solids being deposited from it and forming calculi in the kidney or bladder; or even to dissolve again concretions which have been already formed.

Water is perhaps the most powerful diuretic we possess, although fewer experiments have been made with it upon animals than with the others. The diuretic action of water drunk by a healthy man is very marked, and it appears impossible to explain its elimination by a mere increase in blood-pressure, whether general or local. It has, as we have remarked, the power of increasing tissue change, and thus multiplying the products of tissue waste which result from it, but it removes those waste products as fast as they are formed, and thus, by giving rise to increased appetite, provides fresh nutriment for the tissues, and thus acts as a true tonic. In persons who are accustomed to take too little water, the product of tissue waste may be formed faster than they are removed, and thus accumulating may give rise to disease. If water be freely drunk by such persons, the product of waste will be removed, and health maintained or restored. Thus many gouty persons are accustomed to take little or no water except in the form of a small cup of tea or coffee daily, besides what they get in the form of wine or beer. In such people a large tumbler of water drunk every morning, and especially with the addition of some nitrate or carbonate of potassium, will prevent a gouty paroxysm. Still more numerous, possibly, is the class of people who rise in the morning feeling weak and languid, more tired, indeed, than when they went to bed. Now fatigue may be regarded as the imperfect response of muscles and nerves to stimuli, and such an imperfection in their action may be due either to their imperfect nutrition or to the imperfect removal of the products of their waste. Many such people are well fed, they sleep soundly, and it seems almost impossible to believe that the fatigue which they feel in the morning can result from imperfect nutrition, more especially as one finds that after moving about, the languor

appears in a great measure to pass off. It seems to me that this languor must depend upon imperfect removal of the waste products from the body, as we know that the secretion of urine in healthy persons is generally much less during the night than during the day. I am therefore in the habit of advising such people to drink a tumbler of water before going to bed in order to aid the secretion of urine and of the waste products during the night. In some cases, though not in all, the result has been satisfactory, and possibly might have been still more so had I added to the water the bi-carbonate and nitrate of potassium which, as I have already mentioned, is so useful in cases of gout.

Lately a plan of treating gout by draughts of water at intervals during the day has been a good deal employed and is in many cases successful. As an example of this I subjoin the diet used along with this treatment by a medical friend of mine who has been a martyr to gout, but who feels himself perfectly well as long as he adheres strictly to this course of diet:—

7.30 A.M. Ten fluid ounces very hot water.

8 A.M. Breakfast: Equal parts of weak tea and milk, a small quantity of white sugar, a slice of fat bacon without a strip of lean, bread and fresh butter.

1 P.M. Milk pudding, rice, sago, tapioca, macaroni, or blanc mange, and small biscuits with butter, ten fluid ounces hot water.

4 to 5 P.M. Ten fluid ounces hot water.

6 P.M. Dinner: White fish or fowl (usually boiled), greens, bread, no potatoes, claret seven fluid ounces.

8 to 9 P.M. Ten fluid ounces hot water.

11 P.M. Ten fluid ounces hot water.

If he indulges either in meat or game, or drinks copiously of claret, or omits one or two glasses of hot water, he feels gouty and gravelly next day. It is obvious that by this plan of treatment, in which the ingestion of nitrogenous food is most strictly limited, at the same time that every facility is given for the elimination of the products of nitrogenous waste by the large quantities of hot water drunk in the course of the day, the accumulation of waste in the tissues ought to be most effectually prevented.

Adjuvants to Diuretics.—As the amount of urine secreted

depends upon the difference in pressure between the blood in the glomeruli and the urine in the tubules, it is evident that any pressure on the tubules, whether caused by obstruction of the ureter by a calculus, by the mechanical pressure of dropsical accumulations in the abdomen, or by distension of the venous plexus in the kidney itself, will tend to lessen the secretion of urine. Consequently we sometimes find that in such cases diuretics fail to act until the pressure has been relieved by paracentesis in cases of dropsy, or the venous congestion lessened by the use of a brisk purgative, or by cupping over the loins.

If the venous congestion is very great, as in cases of mitral disease or of chronic bronchitis with emphysema and dilated heart, bleeding from the arm may be advantageous or even imperatively necessary. In dilated heart and in mitral incompetence the action of digitalis on the heart itself, strengthening its action and enabling it more effectually to pump the blood out of the venous into the arterial system and thus to reduce venous congestion, will aid its action upon the kidneys.

IODOFORM IN ERYSIPELAS.

BY C. CLARK BURMAN, L.R.C.P. AND S., EDIN.,

Belford, Northumberland.

SINCE the introduction of iodoform by Dr. Glover in 1837 its sphere of usefulness has been considerably enlarged. Its *internal* administration has up to the present been limited, being confined to some cases of phthisis, gastric ulcer, neuralgia, and chronic rheumatic pains; but *externally* its use has become almost universal, either to the unbroken skin, or as a surgical dressing for wounds, ulcers, and venereal sores. It is also largely employed in affections of the rectum, vagina, urethra, larynx, conjunctiva, and the oral and nasal cavities, where it can be readily applied. In fact, the topical effect of the drug determines to a large extent its employment, rather than its action on the system; though, no doubt, by absorption it may influence the nervous centres, its chief action seems to be upon the peripheral terminations of sensory nerves.

Its action may be described as anæsthetic, absorbent, stimulant or resolvent, detergent or antiseptic, according to the conditions under which the application is made.

The purpose of this communication is to call attention to the well-marked property which the drug in question possesses, of stopping the progress of erysipelas. I may say that I discovered this action accidentally, and as I am unaware of its employment in this affection I have been induced to publish the following cases in the hope of securing a more extensive trial for it in similar circumstances.

CASE I.—For some time I have been accustomed to use a

solution of iodoform in collodion, of the strength of one ounce of iodoform to ten ounces of collodion, as an application to enlarged and indurated glands in the neck and elsewhere. On one occasion while painting some enlarged and painful inguinal glands in a man, the subject of chronic eczema of the lower extremities, he called my attention to a well-marked patch of erysipelas affecting the region of the left ankle and lower part of the leg. The usual characteristic appearances were present—considerable infiltration of the cutaneous textures, redness, and heat, but no vesication ; the patient complained of the burning heat rather than of actual pain. Bearing in mind Sir James Paget's experience of collodion in erysipelas (see page 335 of *Clinical Lectures and Essays*), I painted the surface of the inflamed skin with the iodoform-collodion which I had just been using. On my next visit, to my surprise, I found the erysipelas was better; all heat and pain had gone, and the infiltration was rapidly subsiding. The glands in the groin were also much reduced in size and less painful, and in a few days all traces of the erysipelas had disappeared.

The observation of such a satisfactory result led me to adopt the same local treatment in my next cases of erysipelas.

Case II.—A middle-aged woman had suffered from eczema of the scalp, which had given rise to an abscess over the occiput upon the left side; the abscess had opened spontaneously, and when I was called in had almost ceased discharging. Erysipelas had begun in the neighbourhood of the abscess and spread along the left side of the head, involving the ear, and had then attacked the whole of the corresponding side of the face, extending beyond the middle line for a short distance along the forehead and implicating the right eye to a small extent. The swelling of the tissues upon the left side was so great as to close the eye completely; the pulse was full, rapid, and hard ; temperature over 101°, and during the previous night there had been some mental confusion and wandering. Owing to the intense burning pain experienced in the face and surrounding parts she had had no sleep for several nights. I painted the whole of the inflamed surface with the iodoform-collodion, going about half an inch beyond the line of redness. Almost immediately she experienced relief from the pain, and remarked how very cooling

the application was; that night she enjoyed several hours' refreshing sleep. I prescribed

> Liq. ferri perchlor. ʒvj,
> Sp. chloroformi ʒij,
> Infusi quassiæ ad ℥viij,
> M. ft. mist. Sig. ℥j tertiis horis sumenda.

Upon my next visit a remarkable change had taken place; the swelling of the face had gone down to such an extent that the eye could be freely opened, all pain had ceased, and the disease had not advanced beyond the original mark. Except for the stiffness caused by the collodion my patient felt nothing wrong; the application was repeated, and in a few days I put her on Easton's Syrup, convalescence being fully established.

Case III.—A woman, aged 62, had complained for a day or two of a burning pain over the left parietal and temporal bones, with tumefaction of the scalp and great tenderness on pressure, and when I saw her this was still well-marked; but the disease had now invaded the left side of the face, there was great swelling of the eyelids, profuse lacrimation, intense burning pain over the face and left side of the head, and shooting pains along the left upper jaw; the constitutional disturbance was not excessive. I painted the whole of the left side of the face and forehead and corresponding ear with the iodoform-collodion, and ordered one-eighth of a grain of Sulphide of Calcium every two hours. The progress of the disease was apparently at once arrested, the pain and heat in the face ceased, though the scalp continued tender. I then ordered Easton's Syrup with Compound Tincture of Cinchona, and in the course of a few days she had quite recovered.

Case IV.—While the preceding case was under treatment, I saw another case of facial erysipelas in a woman, aged 69; it was on the left side, but much more extensive than in Case III. and with a correspondingly greater amount of constitutional disturbance. I applied the iodoform-collodion as in the other cases, and almost immediately she expressed her thanks for the great relief it had afforded her. The pain ceased, the burning heat, which all these patients had complained so much of, was entirely relieved, and the disease showed no signs of extending

after the first application had been made. This patient was ordered :—

> Liq. morphiæ ʒiij,
> Sp. chloroformi ʒij,
> Sodii sulphatis ʒiv,
> Tinct. cinchonæ co. ʒvi,
> Infusi buchu ad ℥viij,
> M. ft. mist. Sig. ℥ss tertiis horis sumenda.

In a day or two she was perfectly convalescent.

In the cases just recorded the disease appeared to be *at once* stopped—"jugulated," if I may use the word ; in no case was extension observed after the first application ; in no case did vesication occur ; it seemed as though the cutaneous inflammation subsided immediately under the influence of the drug thus topically applied, and any exudation beneath the epidermis was prevented.

It may be asserted that the successful result was due, in part if not entirely, to the medicinal treatment adopted ; but in Case I. no internal treatment, except a smart purge of Sulphate of Magnesium, was tried, and yet by the next day the disease had subsided. In Case II. I learned that only a few doses of the iron-mixture had been taken, as it produced vomiting ; and in Cases III. and IV. I purposely adopted a different plan of treatment. Even granting that some credit is due to the internal remedies employed, I consider the *immediate* benefit which was experienced in all the cases points to the application as being something more than adjuvant to the medicine. Now Sir James Paget assures us that simple collodion, while giving relief to certain well-marked symptoms, *did not stay the progress of the disease*, so that I think we may safely assume the iodoform played an important if not the chief part in arresting the attack. However, in my next case I intend to withhold all internal remedies and watch the effect of the iodoform-collodion alone ; I shall then be better able to speak positively on this point.

Iodoform thus applied has certainly proved the most successful in my experience of the many remedies employed externally for erysipelas. Among those I have used with but varying success I may mention the Glycerole of Lead (as recommended

by Balmanno Squire), liquid extract of Ergot, spirituous solution of Tannic Acid, and the ordinary Lead and Opium lotion; but with none have I found anything to equal the good effects of iodoform-collodion.

Its prompt relief of the burning pain, which is such a constant symptom of erysipelas, its apparent power of arresting the progress of the disease, and the remarkable freedom from irritation during the period of desquamation following the subsidence of the disease, are all strong reasons in favour of its extended use.

It has disadvantages, I admit, especially its odour, which to some patients is objectionable; this may, however, be overcome. The temporary disfigurement caused by its application, particularly in cases of facial erysipelas, will not I think be urged against it when its advantages are thoroughly appreciated.

Reviews.

The Dissector's Manual. By W. Bruce-Clarke, M.A., M.B. and Charles Barrett Lockwood, F.R.C.S. Crown 8vo., pp. 390, illustrated. London: Cassell and Co. 1883.

The compilation of a text-book for the use of students is acknowledged to be a task of great difficulty. On the one hand there is the danger of redundancy, on the other of deficiency; and the characteristics of precision, perspicuity, and accuracy are especially needful. This last addition to the large number of small text-books of anatomy is intended to take its place as a practical guide, and to occupy a position supplementary to the systematic treatises, such as that of Quain. In point of fulness it is intermediate between the concise and more purely directive work of Cleland, and the fuller and more diffuse guide of Cunningham. It is likely to prove useful to the student who follows its leading as far as such books can be of use; but we gravely doubt whether there is any advantage to be gained by the student from the use of such in preference to the much more complete and satisfactory work of Ellis. Certainly our experience is that students who systematically use that excellent, though undeniably dry, manual learn their business better than those who multiply smaller books to themselves. Of the smaller books we also think that such as are confined to method, like Prof. Cleland's manual, are better than those that dilute their directions with incomplete descriptions. The authors have however produced a fairly readable and fairly accurate book of its sort; but it shows certain signs of carelessness in writing and looseness of description which should be pointed out. For example, the orbital periosteum is described as orbital fascia, the extensor of the metacarpal bone of the thumb is spoken of familiarly as "extensor ossis," and so on. Here and there too slips in matters of fact are detectible, but most of them of trifling moment. The illustrations are poor, often incorrect even as diagrams: take, for instances, Figs. 16,

18, and 22; while some, such as the pictures of instruments, only take up space which might with advantage be accorded to subjects which have been omitted. The chapter on the preparation of bodies might also have been contracted with advantage, as the class for whom the book is written have rarely any need for these instructions, and the directions are insufficient for those to whom they are really necessary.

On the whole, however, this book is creditable to its authors, and, as we have said, will prove about as useful to students as any book of its kind can be.

A Guide to the Study of Ear Disease. By P. McBride, M.D., F.R.C.P.E., &c. 8vo. pp. 198, illustrated. Edinburgh: W. and A. K. Johnston. 1884.

The appearance of another text-book on diseases of the ear suggests that the followers of this department of practice are bestirring themselves to remove the stigma of "no information" which, almost up to so late a period as the beginning of the last decade, obtained respecting it. The latest to appear, that by Dr. McBride of Edinburgh, entitled a *Guide to the Study of Ear Disease*, is uniformly good, and in some respects superior to its predecessors. Especially designed as an introduction to the study of ear diseases for students and the "busy practitioner," the work is well adapted for accomplishing its object. The first chapter treats of the anatomy and physiology of the ear; both are concisely and clearly put, the latter being, perhaps purposely, divested of its many problems to adapt it to the comprehension of the "busy practitioner" aforesaid. The second chapter discusses the physical examination of the ear, and in it the ordinary means of diagnosis are briefly described. The methods of removing foreign bodies from the external ear are considered *inter alia* in the third chapter. Acute and chronic inflammations of the middle ear are then dealt with, and instructions are given for the use of the artificial membrane. We are glad to note that the liability to the occurrence of caries and necrosis in connexion with chronic suppuration of the middle ear is brought to the reader's notice, though dismissed too cursorily considering the importance which these complications frequently assume in this relationship. Perhaps the least satisfactory chapter is that in which chronic non-suppurative inflammation of the middle ear is examined, very little new light being thrown by the author on this obscure affection.

Passing over various subjects usually alluded to in text-books on the ear, we come to that of auditory vertigo. Here we find ourselves upon debateable ground. The author, as might be expected, maintains his previously expressed views of the "overflow theory"; this predicates the existence of a vertiginous

centre in the brain which, when stimulated, permits the impression to radiate to other hypothetical centres, such as that for vomiting, cardiac inhibition, syncope, &c., so giving rise to the associated symptoms of vertigo. The weakness of the argument by which the author combats the alternative explanation—that it is too hypothetical—does not appear to strike him. For it is scarcely conclusive as against either of two hypotheses, to affirm that one is *too* hypothetical. The chapter on *tinnitus aurium* is a good summary of the best that has been written on the subject.

A great feature of the book is the coloured plates: we have seen none equal to them, either in regard of truthfulness or of artistic excellence. Altogether, as we have already said, this text-book on the ear will compare favourably with any in the language.

The Different Aspects of Family Phthisis, in Relation especially to Heredity and Life Assurance. By REGINALD E. THOMPSON, M.D. Cr. 8vo, pp. 238. London: Smith, Elder, & Co. 1884.

THIS volume contains a valuable and careful inquiry into the evidence and laws of the inheritance of phthisis. The statistics upon which the conclusions are based are derived from the records of the Hospital for Consumption and Diseases of the Chest at Brompton, the cases having been collected over a period of more than a quarter of a century. By means of these the author proceeds to prove that individuals who give a history of family phthisis are more liable to phthisis than the community at large; that consumptives giving a history of parental phthisis are disposed to be attacked at an earlier period of life than those who have no such history, and consumptives who give a history of phthisis in both parents are disposed to be attacked at an earlier period than those who have a history of a single heredity only. The general features of acquired phthisis and those of hereditary phthisis are then considered, the males and females being separately dealt with; and a comparison is made between the two forms of disease. It is noticed that in the acquired disease in males the tendency is to assume the subacute form, and copious hæmoptysis is frequent; whereas in the females there is an earlier susceptibility, and a large number of acute cases, but copious hæmoptysis is less frequent. The hereditary cases in the females exhibit an exaggeration of the qualities for the acquired form; while the influence of heredity in the males is to diminish their power of resistance and to impart a tendency to assume a condition resembling that of the females in regard to the acquired form. Differences are also remarked according as transmission takes place through the

father or the mother. An interesting chapter follows on inherited phthisis as compared with other diseases, such as syphilis and insanity, showing its peculiar and marked resemblance to the latter so far as the laws of transmission are concerned. Some useful suggestions based upon the foregoing deductions are given for the assurance of the lives of applicants with a history of family phthisis. There is also much other information of a valuable kind, but enough has been said to show that the labour bestowed by the author on the investigation has been fruitful in bringing much trustworthy evidence to bear upon one, and not the least important, factor in the ætiology of phthisis.

Clinic of the Month.

Orchitis as a Complication of Typhoid Fever.—This complication was first noticed by Velpeau in 1844, but has never met with recognition in standard works such as that of Murchison. Dr. Ollivier has collected twenty-seven cases, and found that it occurred chiefly in young subjects, in sixteen between 16—35, and in five whose age was not mentioned, but were probably young. The fever was usually severe, sometimes alarming, in only three cases mild. In seven cases it appeared during the course of the fever (from eleventh to last days of fever): in twenty during convalescence, dating from apyrexia (from third to twentieth day). When occurring during convalescence, the orchitis is preceded by rigors, fever, and vomiting. Pain is present, but is minimised. In fifteen cases the testicle and epididymis were both affected: in eight the testicle alone. The termination is usually by resolution, but in six cases (almost one-fifth) suppuration occurred with loss of testicular substance. Roughly it differs from gonorrhœal orchitis in coming on more quickly, in more often affecting only one testis, and leaving the epididymis comparatively untouched. It is more analogous to the orchitis of mumps, with this great difference, that in typhoid-orchitis not a single case of consecutive atrophy occurred, whilst in 163 cases of mumps-orchitis collected by Laveran, 103 cases of consecutive atrophy are noted. The ætiology of the orchitis has been discussed by Vidal, who holds that it is due to passive engorgement rather than to true inflammation. Hallopeau thinks that in typhoid fever the testicular parenchyma is in a condition analogous to that of the liver, spleen, and other glands; and that such a condition predisposes to inflammation in the presence of some accidental cause, such as wound or functional abuse. Dr. Ollivier combats these theories, and holds that the explanation has yet to be sought. That the complication has been so little noted is due to its occurrence chiefly during convalesence; but he thinks the clinical facts are now established, and that for

the future orchitis should take a place somewhat similar to phlegmasia dolens, amongst the possible complications of typhoid fever. (*Revue de Médecine,* Oct. and Nov. 1883.)

Tuberculous Auto-inoculation in the Larynx.—Dr. Cadier has had several cases in which he has been able to trace the transmission of tuberculosis from one vocal cord to a symmetrical point on the opposite cord. In the first case, while the right cord presented a rather deep ulceration, a redness only of the symmetrical point on the left was remarked, the contact of the tubercle-bacilli having not yet determined more than irritation and inflammation. Ten days afterwards, a swelling of the inoculated spot was noticed, and epithelial desquamation, and even a little superficial ulceration of the mucous membrane. Finally, eight days afterwards, true ulceration was established, secreting muco-pus, capable in its turn of producing a fresh inoculation. By attentively studying the successive stages of the disease in this patient with the laryngoscope, the author could trace the ulcerating granulations extending on both sides of the first ulceration, and covering by degrees the entire free border of the vocal cords. In the second, third, and fourth cases the same successive symptoms could be made out. In the fifth case, instead of an ulceration, the author first saw an ulcerated swelling on the cord first attacked; but the same redness, and then a more or less deep ulceration, followed in due time upon the other cord. Several other cases of the same kind have come under his notice, but not until a more advanced period of the affection had been reached. (*Annales des Maladies du Larynx,* Sept. 1883.)

Tenotomy for Pianists.—The limited power of extension possessed by the ring-finger is sometimes of great inconvenience, especially to pianists. In the case of men in whom this condition was very marked, Dr. Forbes recently divided the cross fibres connecting the tendon of the extensor communis for the ring-finger with those passing to the middle and little fingers. The operation was almost painless and the wound healed quickly, leaving an almost imperceptible scar. Before the operation the finger could be raised scarcely one-fourth of an inch, but after the tenotomy it could be extended one and one-fourth inch, and lost nothing of its strength in consequence. (*Wiener med. Wochenschrift,* Sept. 22, 1883.)

Visible Capillary Pulsations.—M. A. Ruault recently read a paper before the Clinical Society which relates to the visible capillary pulsations. The symptomatic value of this phenomenon was first indicated by Quincke. According to this

author the capillary pulse, indicated by alternate redness and pallor of the tissues concerned, isochronous with the cardiac systole and diastole, is specially observed under the finger-nails in healthy subjects as well as in slight chlorosis and particularly in aortic insufficiency. It is occasionally accompanied by a similar pulse visible at the fundus oculi, by means of the ophthalmoscope. M. Ruault's communication relates, however, to a variety of visible capillary pulse which may be observed on a so-called vasomotor spot, produced by rubbing the forehead with the finger-nail. The capillary pulse is plainly seen in these congested areas if the observer's eye be maintained at a distance of thirty or forty centimetres from them, and the cardiac pulsations are easily counted. M. Ruault has never observed the capillary pulse in healthy persons, but frequently in chlorotic patients and in those suffering from lead poisoning, whose arteries presented the fibroid degeneration known as arterio-sclerosis. The pulsations in question were most constantly observed, however, in patients with aortic insufficiency, especially in those whose cardiac action was regular and strong. It therefore seems that the capillary pulse can only occur in those pathological conditions which are attended by co-existing augmented cardiac impulse and general arterial contraction, as is frequently the case in arterio-sclerosis. [*Practitioner*, xxxi. 378.] (*Journal de Médicine et de Chirurgie Pratiques*, Oct. 1883.)

Corrosive Sublimate in Surgery and Midwifery.—Mr. W. Robertson suggests the use of a solution of mercuric chloride of strength of one-sixteenth of a grain to eight ounces of water, as an antiseptic dressing. A case is noted of a boy who sustained an injury to the elbow-joint, and, notwithstanding the use of carbolic dressings, suffered from much suppuration and fever. About four weeks after the accident the dressings were changed for one in which a solution of the mercuric chloride was applied to the wound; the suppuration soon became less, the temperature came down, and the patient rapidly improved. Other cases are referred to in which the action of this salt proved most beneficial. (*Brit. Med. Journ.* Nov. 3, 1883.)

Since April 1882, Dr. Kehrer of Heidelberg has used corrosive sublimate in two hundred and twenty-one labours. In four only was there an urticarious eruption, beginning on the thigh and extending over the whole body. This disappeared in three or four days. Attacks of stomatitis occurred in one lying-in woman and in three gynæcological cases; the first having previously undergone a process of inunction, and two of the last had been taking mercury. Kehrer first used corrosive sublimate solutions of 1 to 2,000; lately, of 1 to 1,400. During labour he makes a vaginal irrigation before making the vaginal examination. As

to the results of corrosive sublimate disinfection in the lying-in state, he states that two-thirds of the women remain entirely free of fever. Before the use of the sublimate two-thirds of them had febrile reactions. Kuestner, in discussing Dr. Kehrer's paper, was strongly in favour of the use of sublimate as a means of thorough disinfection. He has found that, after carbolic irrigation of the uterus, the micrococci do not disappear, but their disappearance is very prompt after the sublimate irrigation. (*Centralbl. f. Gynäkol.* Nov. 3, 1883.)

Paolo Negri has adopted this agent as an antiseptic at the Maternity at Novare. He finds a solution of one to two thousand sufficiently strong as a rule. During four months at this Maternity, the statistics show not one death among the fifty-one cases; and but very little sickness. Negri draws the following conclusions:—(1) The toxic effects of corrosive sublimate employed in the usual strength, one to fifteen hundred or two thousand, is almost nothing; in one case only he had slight mercurial exanthema. (2) The solution of the strength of one to two thousand is sufficiently powerful to prevent puerperal sepsis. (3) This solution will completely take the place of the two to one hundred solution of carbolic acid generally used. (4) The sublimate has the advantage over carbolic acid of being cheaper, and having no odour; this last consideration being not unimportant in private practice. (*Bull. Gén. de Thérap.* Oct. 30, 1883.)

Inhalations of Oxygen in Leukæmia and Pseudo-leukæmia.—In a lecture given by Dr. Kirnberger before the Medical Society at Mayence on the treatment of leukæmia and pseudo-leukæmia, he suggests the inhalation of oxygen as a means of obviating the retarded tissue-metamorphosis which is characteristic of these diseases. He cites a case in which he employed this treatment with good results. The patient, a boy aged 10½, who had been treated with iron, arsenic, and quinine without any benefit, improved greatly, and finally was cured after the inhalation of oxygen, combined with arsenic internally. The boy had reached a condition of extreme weakness, being entirely confined to bed, with loss of appetite and tendency to vomiting; the spleen was considerably enlarged, and the white and red blood-corpuscles in the proportion of 1 to 90. The treatment began in December 1882, and after a daily inhalation of about 30 litres the boy could leave his bed in ten days, and could go to school about the end of February. Some variations in his condition occurred from time to time; but about the middle of September the author considered him to be definitely cured, the number and proportion of red corpuscles having returned to the normal. (*Deutsche med. Woch.* Oct. 10, 1883.)

Extracts from British and Foreign Journals.

Action of Cantharides on the Kidney.—The experiments made by Dr. Ida Ehaschoff in the laboratory of Professor Langhans have led to the following results, which to a great extent confirm those of Cornil. The alterations in the kidney after poisoning by cantharides affect both the glomeruli and the tubules of the kidney. The glomeruli present the characteristic symptoms of inflammation, the secretion of urine is lessened or almost completely stopped, while an albuminous exudation which coagulates on heating is poured out, and white and some red blood-corpuscles also pass out of the vessels. This is the only part of the vascular system of the kidney which shows any great alteration, for in the stroma diapedesis of leucocytes could in no way be discovered, and only a few were to be found in the collecting tubules and medullary papillæ. The changes in the tubules are like those of the glomeruli, and affect all the tubules of the cortex, the collecting tubules, and the ascending limbs of the border layer. They consist in the breaking up of all the inner half of the epithelium, which either falls off or undergoes granular degeneration: many nuclei are lost and fall into the lumen of the tubule. The peripheral parts of the epithelial lining, with the remainder of the nuclei, remain as a thin continuous layer on the *membrana propria.* The ascending limbs are more resistent and are later in undergoing alteration than the other parts of the tubules. The collecting tubules of the medulla undergo simple epithelial desquamation; and this is the part of the tubules into which, next to the glomerulus, the leucocytes are observed to penetrate most freely. Fibrinous casts were only observed once, and were then found in the medulla. The reason of this probably was that death occurred too soon, for there could be little doubt that the granular nucleated protoplasmic masses of the cortical tubules would also form casts later on. (Compare *Practitioner*, xxv. 53.)

A Mode of Identifying the Ends of a Piece of Small Intestine.—Dr. R. Frank Rand writes:—It is confessedly diffi-

cult to determine the course, as between duodenum and cæcum of any portion of the small bowel which may present when an opening is made into the abdominal cavity; as, for example, in a section made for the relief of intestinal obstruction. Operators have ere this passed feet of intestine through their hands, uncertain as to whether they were proceeding upwards or downwards in the direction of the length of the tube. In those cases where an opening is made into the abdominal cavity sufficiently large to admit the hand, the mesentery may be taken as a sure clue, if the attachment of its root be borne in mind. This attachment, it will be remembered, runs along the front of the spinal column in an oblique line from the left side of the second lumbar vertebra to the right sacro-iliac synchondrosis; it corresponds roughly with the long axis of the trunk. Above, it comes into relation with the upper end of the small intestine at the commencement of the jejunum; below, it leaves it at the cæcum. At the spine the two surfaces of the mesentery face laterally right and left; further out their arrangement, like that of the bowel, is constantly varying. As we may speak of a right and of a left surface as regards the mesentery, so may we, none the less, as regards the bowel. It is difficult to identify the right and left sides of the bowel, but those of the mesentery are, at its root, self-evident, for here it occupies but some six inches in extent of length, whilst at its periphery it reins in some nineteen feet or so of tube. The right and left sides of the bowel having been identified, a knowledge of the proximal and distal ends follows in necessary sequence. The peritoneal cavity having been opened at any point in the anterior abdominal wall, the first piece of small bowel presenting may be seized; its long axis being held in the long axis of the body, and its attached mesentery being pulled out taut from the spine, the hand may be passed, guided by the mesentery, backwards to the spine, when it may be passed upwards and downwards without hindrance along its spinal attachment. If the bowel is being held in its true direction, the hand passed to the right of it will be conducted by the mesentery to the right side of the spinal column, and, passed to the left of it, it will be conducted to the left side; but should the apparently upper end of the bowel be not really so, the hand, in passing to its right side, will be conducted by the mesentery over to the left side of the spine, and, conversely, if passed to its left side will be conducted over to the right; in either case the hand being passed upwards and downwards to identify the mesenteric root. Nothing can be simpler in practice, as may be found by making trial and test in the post-mortem room. I have no doubt this method has been used in the past, but having found no record of it, have thought it worthy of mention. (*Lancet*, Dec. 22, 1883.)

Scabies without Itching.—Jourarmand remarks that: (1) Pruritus may be absolutely absent in scabies—(*a*) in anæsthetic patients; (*b*) in patients preserving all the recognised characteristics of physiological cutaneous sensibility. It would almost seem that there exists a special sensibility to the acarus or to the acarian virus. (2) Scabies without itching is rare, but is more frequent than is generally believed, because one usually searches no further than the objective signs. (3) It must lead to numerous errors of diagnosis, and the only means of avoiding them is to search for the acarian furrow, whenever there exists a polymorphous eruption, even should there be no itching. (*Thèse de Paris:* Abstract in *Journal of Cutaneous and Venereal Diseases.* Vol. 1, No. 14.)

Characters of Blennorrhagic Sciatica.—Brisson states that in the course of blennorrhagia among men and women there may develop a sciatic neuralgia which is, in the majority of cases, attributed to some other cause than blennorrhagia itself. The same is true of arthritis, hydrarthrosis, ophthalmia, and the other manifestations of blennorrhagic rheumatism; the urethral discharge alone is capable of producing them. This relation is demonstrated by the following considerations: (1) sciatica and blennorrhagia co-exist too often in the same individual for this association to be referred to the hazard of chance. (2) Sciatica figures most frequently among the concomitant lesions due to urethral rheumatism. (3) It is observed to be re-developed in successive attacks of urethral rheumatism. (4) In a series of rheumatisms of this kind it alternates at times with manifestations of the same nature but of different location. (5) It disappears by anti-blennorrhagic treatment. (6) It appears in a blennorrhagic patient with a group of symptoms which, in certain respects, differ from those of ordinary sciatica. (*Thèse de Paris:* Abstract in *Journal of Cutaneous and Venereal Diseases.* Vol. 1, No 13.)

Hypodermic Injection of Iodide of Potassium.—M. Gilles de la Tourette confirms a statement previously published by M. Besnier to the effect that in the rare cases in which the administration of iodide of potassium by the mouth cannot be tolerated the medicine may be safely injected subcutaneously. A cubic centimetre of distilled water containing half a centigramme of the iodide may be injected, provided the solution is neutral. The injections should be made into a part rich in areolar tissue, and at points not too close to one another. (*Annales de Dermatologie et de Syphiligraphie.* Vol. 4, No. 10.)

Albuminuria as a Consequence of Cutaneous Excitement.—Kemhadjian Mihran (*Thése de Paris,* 1882) states that

cutaneous excitement, by whatever means produced, may give rise to albuminuria. The amount of albumen, which in such a case can be almost at once detected, will vary according to the degree of excitement, the energy of the exciting agent, the extent of surface acted on, and the duration of the excitement. The duration of the albuminuria will also be determined by the same conditions; in most cases it is transient, but, under the influence of extreme peripheral irritation, it may persist, along with an alteration in the organic structure involved. Albuminuria proceeding from cutaneous excitement depends proximately on a disturbance of vaso-motor innervation. (*Journal of Cutaneous and Venereal Diseases.* Vol. 1, No. 10.)

Local Treatment of Acne.—M. Morin takes a fine darning-needle, having an eye somewhat longer than a sewing-needle. Holding this by the point, he introduces it into the affected gland by a rotary movement which causes some of the sebaceous matter to lodge within the eye of the instrument. The latter is withdrawn, cleansed, and reintroduced, and the operation is repeated once or twice, until, the gland being emptied, its floor is touched by the needle, when a slight pricking sensation is experienced. The same needle, or another similar one held in the same way, is then dipped in an alcoholic solution of iodine—of greater or less strength, but never weaker than that of the French Pharmacopœia—and is again passed into the gland charged with a drop of the iodine tincture, which is thus brought into immediate contact with the focus of the disease. After a few minutes a clear liquid slightly coloured by the iodine will exude from the gland, sometimes in a drop as large as a tear. This flow will cease within an hour; twenty-four hours later, in cases of acne simplex, the inflammation, when unaccompanied by suppuration, will have wholly disappeared. If, however, suppuration existed, it will be found perceptibly diminished, needing only two or three of the repetitions of the process to effect its entire cessation, followed by a permanent cure. (*Thèse de Paris:* Abstract in *Journal of Cutaneous and Venereal Diseases.* Vol. 1, No. 12.)

Notes and Queries.

The Prevention of Blindness in Infancy.—The following instructions, based upon the directions of the Society for the Prevention of Blindness, have been issued by a committee of the Manchester and Salford Sanitary Association, for the information of mothers and nurses. Judging by our own experience such instructions are greatly needed, and the effort of the committee is worthy of all encouragement.

"One of the most frequent causes of blindness is the inflammation of the eyes of new-born babies. Yet this is a disease which can be entirely prevented by cleanliness, and always cured if taken in time.

"The essential precautions against the disease are:—

"1. *Immediately after the birth of the baby, and before anything else is done*, wipe the eyelids and all parts surrounding the eyes with a soft dry linen rag; soon afterwards wash these parts with tepid water before any other part is touched.

"2. Avoid exposing the baby to cold air; do not take it into the open air in cold weather; dress the infant warmly, and cover its head, because cold is also one of the causes of this eye-disease.

"When the disease appears it is easily and at once recognised by the redness, swelling, and heat of the eyelids, and by the discharge of yellowish white matter from the eye. *Immediately* on the appearance of these signs *seek the advice of a medical man;* but in the meantime proceed at once to keep the eyes as clean as possible by very frequently cleansing away the discharge. *It is the discharge which does the mischief.*

"The cleansing of the eye is best done in this way:—

"1. Separate the eyelids with the finger and thumb, and wash out the matter by allowing a gentle stream of lukewarm water to run between them from a piece of rag or cotton-wool held two or three inches above the eyes.

"2. Then move the eyelids up and down and from side to side in a gentle, rubbing way, to bring out the matter from below them; then wipe it or wash it off in the same manner. This

cleansing will take three or four minutes, and it is to be repeated regularly *every half hour* at first, and later, if there is less discharge, every hour.

"3. The saving of the sight depends entirely on the greatest care and attention to cleanliness. Small pieces of clean rag are better than a sponge, as each rag is to be used once only and then burnt immediately; sponges should never be used, except they are burnt after each washing.

"4. A little *washed* lard should be smeared along the edges of the eyelids occasionally to prevent them from sticking.

SPECIAL WARNING.

"Of all the mistaken practices which ignorance is apt to resort to, none is more ruinous than the use of poultices. Let them be dreaded and shunned as the destroyers of a new-born baby's sight. Tea-leaves and sugar of lead lotion are equally conducive to terrible mischief, stopping the way as they do to the only right and proper course to be taken."

LEBON AND CO.'S CLINICAL FIGURES.—We have received specimens of outline figures of the trunk, with thoracic and abdominal viscera, the *fundus* of the eye, the head in various aspects, and of a number of sections of the brain; the outlines are clearly and accurately drawn, and are gummed at the back. They are intended to be used in clinical note-books both by practitioners and students, and in their way are more perfect than anything of the kind we have seen. No one who has experienced the gain in definiteness, and the avoidance of verbiage, obtained by the use of a few lines localising a lesion or symptom on an already prepared diagram will be willing to dispense with such aids as Messrs. Lebon and Co. have under skilled advice produced. The brain-sections especially are likely to lead to the collection of valuable observations even by physicians who have not made nervous diseases a specialty, and who are sometimes unable to describe the locality of a lesion with precision from want of familiarity with the complicated and difficult minuter topography of the brain. By means of these diagrams the lesion can be noted on the area over which it is seen, and the description of the site in words can be drawn up at leisure afterwards.

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*** Any of the foreign works may be procured on application to Messrs. Dulau, of Soho Square, W.C.; Williams and Norgate, of Henrietta Street, Covent Garden, W.C.; or Baillière, of King William Street, Charing Cross

Department of Public Health.

SOME NOTES ON THE CHOLERA AT DAMIETTA IN 1883.

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(*Continued from* p. 320.)

THERE seems to have been no doubt about the origin of the cholera epidemic of 1865. It was clearly an importation. That of 1883 has not however been so clearly ascertained, perhaps owing to the inherent difficulties surrounding the investigation, especially when increased by the political and commercial spectacles through which, unfortunately, the whole question was viewed from the very first.

In support of the theory that in 1883 the cholera was imported either directly or indirectly from India, two persons are particularly mentioned as being likely carriers of the disease into Damietta.

1. Mohammed Khalifa, a fireman on board the *Timor* from Bombay.

2. Ayouzi al Zendaia, a woman trading between Port Said and Damietta.

When Khalifa was first put forward as the importer of the disease, Dr. Chaffey Bey and Dr. Ferrars showed very conclusively he did not arrive in Damietta until after the outbreak had commenced. He was in prison at Port Said on the day when the cholera broke out. The authorities at Damietta now state that some important facts have been omitted by the doctors.

The Governor informed me he had proof in his hand that Khalifa visited the town immediately on leaving his ship, and it was only after he had returned from Damietta to Port Said that the Governor of the latter town put him in prison. According to a written statement I received from the Governor, Khalifa arrived at Damietta on the 13th or 14th of the Challan, which corresponds to the 19th or 20th of June. He came to visit his parents, who reside in the town, but on that day, not expecting their son, they had gone over to Port Said. Khalifa therefore went to a café in Damietta, much frequented by sailors (kept by Salem el Sandouli); there he got into trouble, was arrested and put in prison, where he remained until his parents returned and begged for his release, which the Governor granted. After this, Khalifa started off for Port Said, and conducted himself so noisily in that town as to be arrested and imprisoned. A few days after Khalifa's visit to the café, Salem el Sandouli and his assistant died of cholera—further, their deaths occurred on the same day. Both men lived in a quarter of the town where the cholera first broke out violently, which was a considerable distance from the café. These are the facts in support of Khalifa having imported cholera. He seemed to have been fixed upon simply because he was the only one in Damietta who had a remote connexion with Bombay. I made particular inquiries into the sickness and death of the two café men, and ascertained they were only ill one or two days. They died on June 28th, *i.e.*, eight or nine days after Khalifa's visit. They were by no means the first attacked by the disease in the quarter in which they resided, nor had Khalifa visited this part of the town. On June 22nd there were six deaths from cholera, on the 23rd thirteen deaths, and more in daily increasing numbers before either of these men took ill. They were well while those around them were dying fast, and they only became victims of the cholera *after* a large number of their neighbours had succumbed—on the day, indeed, when there were 101 deaths. To suppose that these men, even if infected by Khalifa, had spread the disease before they took ill, or to such an extent, is to suppose an impossibility; moreover, Khalifa himself was never ill; from all description given of him he appears to have been drunk, and it is quite certain he did not come from an

infected ship. Granted here that there had been some facts omitted, and that Khalifa had visited Damietta immediately on leaving his ship, there is still not the slightest evidence to connect him in the least degree with the epidemic.

The second case brought forward is as deficient in proof as the first. A woman named Ayouzi al Zendaia some years ago lived with her mother in Damietta, but, getting married, she removed to Port Said. In the latter town she began business, and carried coffee, silk, &c. from Port Said to Damietta, returning with other exchanged articles of merchandise. When in Damietta she usually visited the house of Mohamed Dalia. In this house lived a woman named Fatma. Fatma and Zendaia were great friends, and on these visits frequently spent a long time in each other's company. Fatma, knowing how to do Syrian cooking, was invited by Ali Markili, a friend, to a banquet, in order to prepare a Syrian dish. She went to the house on Tuesday, June 19th, was attacked with vomiting and purging the same day, and died the following night. Soon afterwards the negress servant of Ali Markili died of cholera, and in a few days the wife of Ali Markili herself.

The movements of Zendaia were as follows:—She arrived at Damietta from Port Said on Challan 6th, which corresponds with our June 12th. She did not see the Syrian woman who lived in the same house until June 16th, but in the meantime went over various parts of the town. When the two women met they remained in each other's company the most part of the day. On June 20th, four days after the first interview, the Syrian woman was dead. Twelve days after the arrival of Zendaia, the wife of Mohamed Dalia, the owner of the house, died of cholera. A few days before the death of the landlady Zendaia visited her brother, residing on the other branch of the river Nile, and two days after the visit the daughter of this brother is said to have died of cholera. On June 24th Zendaia departed for Port Said, and three or four days after was attacked with cholera herself. An examination of the register of deaths gives some information bearing on the above statements. It shows—

(1) The Syrian woman died on June 20th, registered acute gastro-enteritis.

(2) The wife of Dalia, the owner of the house, died on June 24th.

(3) The negress servant of Ali Markili on June 29th.

(4) The wife of Ali Markili on July 1st.

(5) The name of Zendaia's niece could not be found in the register (since my arrival in England the date has been kindly forwarded to me, it is put down as July 15th).

If Fatma was the first person attacked with cholera at Damietta, it is possible the wife of Dalia, living in the same house, caught the infection from her. It is, however, very improbable that the death of the negress servant or of the wife of Ali Markili was due to Fatma's visit before she showed any signs of illness; but the deaths were more probably due to that general cause which was destroying at the time over 100 persons a day.

Even if Fatma was the first attacked with cholera in Damietta there is no evidence of any worth to show that Zendaia brought the disease with her, nor is it traceable that any one else brought it to the house.

As mentioned before, Zendaia herself was attacked with cholera at Port Said on June 27th or 28th, eight days after the death of Fatma. Instead of Zendaia importing cholera into Damietta, she became infected at Damietta, and was one of those who conveyed the cholera to Port Said.

These cases, or others of a similar kind, do not explain the origin of the epidemic; besides, in the several investigations the deaths alone have been considered. Because there was one death distinctly choleraic on June 20th, and six deaths on the 22nd, June 20th has been hastily decided upon as the first day in which cholera appeared in Damietta. My investigations, however, led me to a different opinion, namely, that cholera was present in Damietta before it ever came to the public notice, not in an epidemic form, but gradually accumulating its energy for the apparently sudden outbreak.

If we look at the monthly deaths for 1882 and 1883 we see a greater number in the months of January, February, March, April, May for the year 1883 than for 1882.

TABLE SHOWING THE MONTHLY DEATHS FOR THE TWO YEARS.

1882.				1883.			
Month.	Male.	Female.	Total.	Month.	Male.	Female.	Total.
January......	38	42	80	January......	66	63	129
February ...	37	36	73	February ...	78	57	135
March	45	35	80	March	72	45	117
April	40	38	78	April	52	50	102
May	43	44	87	May	58	49	107
June	59	35	94	June ...... {	to 21st, 43 after, 328	43 } 342 }	756
July	54	31	85	July	759	799	1,558
August	56	60	116	August	67	92	159
September...	69	39	108	September...	57	55	112
October	41	40	81	October			
November...	35	44	79	November ...			
December ...	53	47	100	December ...			

The excess in the number of deaths appear to be largely due to extra bowel complaints.

TABLE SHOWING THE NUMBER OF DEATHS IN EACH MONTH CAUSED BY BOWEL COMPLAINT.

1882.					1883.					
Month.	Diarrhœa.	Dysentery.	Gastro-enteritis and typhoid.	Total.	Month.	Diarrhœa.	Gastro-enteritis and typhoid.	Cholera.	Dysentery.	Total.
January......	6	3	9	18	January......	16	4	—	21	41
February ...	5	6	8	19	February ...	10	13	—	16	39
March	3	9	8	20	March	11	12	—	17	40
April	5	8	7	20	April	13	16	—	3	32
May	8	14	5	27	May	7	24	—	15	46
June	7	10	5	22	June	16	15	536	18	585
July	5	13	11	29	July	2	11	1,377	12	1,402
August	11	14	10	35	August	0	9	15	7	31
September...	11	10	13	34	September...	10	12	—	7	29
October	6	10	9	25	October					
November...	10	14	9	33	November...					
December ...	13	19	3	35	December ...					

It should be borne in mind: (1) The register was not kept correctly with regard either to entries of death or names of

diseases. There were causes of death put down which even the native doctor did not comprehend. (2) The case claimed by the authorities to be the first case of cholera was registered acute gastro-enteritis. (3) For at least two months previous to June 20th there had been an unusual number of cases marked down acute gastro-enteritis.

Besides these there was the additional fact that before cholera became epidemic an unusual sickness, consisting mainly of diarrhœa and vomiting of a very prostrating kind, was prevalent in and around Damietta; many deaths were caused by it.

There came to my notice many instances of people having suffered; some of the more trustworthy may be particularly mentioned.

(1) A woman called Houria Manné, who made and sold bread, was on May 4th attacked with vomiting, purging, and cramps in the limbs. Her whole body became unnaturally cold, her eyes were sunken, and she was only able to speak in a whisper. The diarrhœa and vomiting lasted two days and then suddenly ceased, but the woman was so debilitated as to be quite unable to rise from bed until ten days after. During the epidemic she saw many of her friends and neighbours attacked with cholera, and is confident her illness was also cholera.

At the time of her illness a young man was attacked in a similar manner in the same house.

(2) On May 14th a barber in the town was attacked with diarrhœa, vomiting, and cramp. He was taken home, and it was several days before he recovered. A friend who was with him at the time had a similar attack. The barber's son died in the same month after a few days' illness. The death was registered typhus fever, but so far as I could ascertain most of the symptoms consisted of vomiting, purging, and rapid collapse.

(3) The wife of the servant of the Acting German Consul was attacked with choleraic symptoms on June 1st.

(4) The servant of the Austrian Consul was attacked with all the symptoms of cholera on June 4th. But if these and others which I have not mentioned were sporadic cholera cases, why did it not become epidemic at once?

The explanation appears to me to be this: the cholera poison

was present in the town, but could not assume an epidemic form until the drinking water was thoroughly contaminated. This happened when the Nile had reached its lowest points, and continued for the first few days after the Nile had begun to rise. The cases here and there in various parts of the town a month or two before were from local contamination of the water kept in the house. There may have been a few instances from direct contagion, but nine-tenths appear to me to be due to some other cause than direct contagion. Although the origin is pushed back to an earlier date, the question still remains, Were the cases in the earlier part of the year due to importation or spontaneous generation? I think we may put endemicity aside. If the disease had been endemic in Damietta, it had many opportunities when the Nile was low of becoming epidemic. That it did not is fairly certain, for however incorrectly the register books may be kept, an epidemic of considerable size could not pass unnoticed. Whether the disease was endemic in other parts of Egypt I am unable to say. In the villages of Upper Egypt, where most of the diseases are registered as caused by the evil spirit—or devil—there is no surmising what diseases may be present. I cannot say I am much in favour of a spontaneous generation, although it must be admitted, if ever a state of filth, in its general sense of pollution of soil, water, air, and food, produced cholera, Damietta possessed the wherewithal in a high degree. My time did not allow me to examine this point as it deserved.

In regard to importation there was one curious fact which struck me. Several of the sicknesses and deaths from acute gastric enteritis were amongst devout and religious people. Could the cholera be traced to some returning pilgrims from El Hedjaz about December 1882? And this is the more likely since cholera was prevalent at Mecca at that time. If enquiries were made in this direction I think they would probably be crowned with success—unlike those purporting to prove the direct importation of cholera from India into Damietta through Port Said.

As a result of my visit to Damietta I can confidently assert that the cases hitherto brought forward, whether of sailors or of Indian merchants or of natives bringing cholera into Damietta,

fall to the ground when strictly scrutinised. The Arabs do not attach much importance to dates, so that details which appear conclusive enough to them do not bear analysing; but though the cases brought forward do fall to the ground, I am sensible that this fact does not disprove importation, for the cholera may have been imported in some other way, such as I have indicated.

The purport of the foregoing notes may thus be summed up:

(1) The sanitary condition of Damietta is unusually bad, even for a town in Egypt.

(2) The cases alleged to have been the means of introducing cholera into the district, upon examination entirely break down.

(3) There were cases occurring with all the characteristics of cholera before the prominent outbreak.

(4) There is room to suspect the true introduction may have occurred through the return of pilgrims.

(5) The endemic origin in Damietta cannot be well supported on account of the long interval between the two great epidemics, with unusual facilities present almost every year for it becoming epidemic. It is not intended hereby to deny its alleged endemicity in the upper parts of Egypt.

There is one important point forgotten (by the Egyptian Government), that whether imported or not, the epidemic assumed its gigantic proportions by the utter disregard of cleanliness. A people that does not provide for a safe removal of its effete matter, but allows it free access to its drinking water, are practising habits which are not only a danger to themselves, but also to all European nations who have communication with them. Quarantines, cordons sanitaires, and other similar devices, are abused. Except at the time of terror, they are only partially carried out, and nothing after all is beyond a bribe.

When in Egypt it was to me a matter of regret to see other nations, such as France and Germany, send out scientific medical men especially to investigate, not only the origin of the recent epidemic, but the nature of the poison or germ, while England was content with cleaning up and sending medical aid. This action on her part was no doubt the most efficacious at the

time, but since she possesses the largest part of the commerce from Egypt and through the canal, surely it was to her best interests to learn exactly how the epidemic arose. With knowledge acquired it would have been easier to have prevented another outbreak. Other nations clamour for quarantine; a long quarantine bears no value in Egypt.

OUTBREAK OF ENTERIC FEVER AT KENDAL.

During January and February of this year an outbreak of enteric fever occurred in Kendal, which deserves notice not only on account of the somewhat special circumstances under which it took place, but also by reason of the careful investigation into its etiology which has been carried out by Mr. C. E. Paget, the Medical Officer of Health. Between January 14th and February 12th at least fifty-six persons were attacked, the principal attacks occurring in special bursts, the most marked of which were during January 14th to 19th, on January 22nd, and again on January 26th to 28th. The attacks were severe, the death-rate exceptionally high, namely, 20·3 per cent., and the fatal cases exhibited complications, such as hæmorrhage and perforation of the bowels, pneumonia, etc.

The outbreak, as recently reported on, could not be traced to either milk or water—the most usual causes of *sudden* and *extensive* prevalences of enteric fever—and became all the more interesting from the fact that, considerable as was the incidence of the disease, it was curiously localised to one special portion of the town. When the localisation of the fever became more or less apparent, Mr. Paget appears to have searched with some diligence for local, and, as he has called them, "predisposing" causes, which differed in this particular district from the rest of the town, and for special "exciting" causes which might influence their action. Without indulging in any elaborate theory as to their method of action, he has simply recorded the unusual conditions and occurrences which he met with, and has suggested in what way their combination may have brought

about the outbreak. Local conditions having been found manifestly insanitary, he was perhaps justified in attaching very great importance to their possible connexion with the outbreak, and some experiments which were undertaken to test his opinion showed results which could not be overlooked.

The combination of causes which he has described in detail as probably answerable for the outbreak is thus tabulated :

1. Excessive rain-fall, which, during the month of January reached 7·96 inches, and which must have thrown a severe strain upon the town sewers.

2. Position of the main sewer.

3. Deficient ventilation of the main sewer.

4. High temperature for the time of year, the mean for each day in January being 41·8° Fahrenheit.

5. Sudden barometrical changes, the mercury falling 3·5 inches in twelve hours on January 10th, 1·35 inches on the 21st and 22nd, and 0·6 inch on the 26th.

6. Insanitary circumstances of houses infected.

It is quite possible that other causes may have entered into the combination which altogether escaped Mr. Paget's attention, but no others seem to have come to his notice, or, if they did, to have plainly indicated their importance. It is quite clear however, that he attributes the outbreak to the escape of sewer gases, and—what is perhaps more important still—to sewer vapours, brought about by an aggregate of circumstances which might singly have been insufficient to cause it.

It is not our intention to criticise the method of action as set forth in the report, but rather to draw attention to certain questions which are raised concerning the conditions of the houses where fever cases arose, and the circumstances of the main sewers. Out of thirty-eight houses examined, thirty-one —or 81·5 per cent.—were found to be in an insanitary condition, either through defective water-closets, the soil-pipes of which were with a single exception unventilated; waste-pipes that were directly connected with the drains; defective traps; foul privies; and rain-water pipes which, though opening under bedroom windows, were directly connected with the drains. The main sewers of the affected district were, apparently owing to inequalities of the ground surface, separate from those of the

rest of the town, although eventually discharging at the same point upon the sewage farm. The chief difference between the two systems lay in the fact that one was well-ventilated and the other was not; and as an instance of how deficient the ventilation was, it may be noted that about 800 yards were found unventilated except for a six-inch iron shaft placed at either end of this length. Mr. Paget maintains that with such a want of ventilation in main sewers gases are liable to force weak sewer connexions whenever from special circumstances they are pent up and have no legitimate means of exit. He might have illustrated his meaning by saying that such sewers may become at times nothing less than elongated gasometers, and the direct or defective house connexions simply their service-pipes with the stopcocks turned on. It is now generally admitted that no sewerage system can be considered in the least degree satisfactory which is not freely ventilated, and we are glad to note from the concluding remarks of the report that the ventilation of all the main sewers in Kendal has now been put upon a satisfactory footing.

Mr. Paget has however drawn very special attention to the defective state of the traps under many waste pipes, and has contended that although these may be exposed to the outer air yet the conditions of their position and treatment may at times cause them to be means of direct communication between the drains and the interior of houses. It appears that in Kendal the gulley-trap is that which is in common use, and that the sink-pipes discharge directly over these with their mouths downwards, and are not themselves separately trapped. The advantage of the traps being free to the air is that when sewer gases are absorbed by the water in them they may be at once dispersed through the atmosphere and not passed up through waste-pipes into the interior of houses. But under special circumstances, as when, in the dwellings of the poorer classes, the waste sink is fixed in the living-room, and a fire is kept burning, an untrapped waste-pipe opening directly over a gulley trap may offer a passage for sewer gas into the house. For when the temperature of the room is higher than that of the outer air and of the interior of the drains, more sewer gas is readily sucked into the heated room than dispersed by atmospheric currents, unless the circulation of

the air around the traps be very free and the currents strong. Mr. Paget however goes further, and expresses his belief, founded upon experiments, that a foul condition of gulley-traps assists the absorption of sewer gases, or enables the latter to pass more easily through them, and so enhances the risks which arise from the close proximity of waste-pipes to traps. Most persons know how foul sink traps become from the collection in them of grease, small pieces of food, and dirt of all kinds, and from the decomposition of these matters when the traps are not vigorously and regularly cleaned out; nor will they be surprised to learn that on the accumulations referred to being stirred up, sulphuretted hydrogen is sometimes evolved. In such conditions traps are little else than small open cesspools placed in dangerous relation to dwelling houses. Mr. Paget poured into the main sewer of a street, where there were several cases of enteric fever, a strong solution of oil of peppermint and spirit mixed with boiling water, with the result that several houses smelt in a short time intolerably of peppermint. His words as to this may be conveniently quoted: "The peppermint odour found its way into five houses where the traps were in a foul condition, and into others where there were more direct connexions with the drains; with but one exception the fever cases were found in some one or other of these houses, and the exception was in a house where the slop-stone had been only lately disconnected from the drains and removed from the damp cellar in which it had been fixed. In the houses where there were foul traps the smell was noticed either at once over the trap or at the slop-stone itself." The results thus obtained seem to be almost too successful, but even were they much less so they would point to the same conclusion, that foul gulleys with untrapped house pipes opening over them constitute dangers to health and life. This is nothing new, but the reiteration of the principles involved may in time induce sanitary authorities so to view their duties and responsibilities as to protect by regulations the lives of those who maintain them. The Local Government Board so far back even as 1877 laid down the lines upon which waste-pipe discharges should be made, and in 1882 the model bye-laws were further elaborated and illustrated with lithographs and wood-cuts. All waste-pipes should be made to discharge into an open channel leading to a

trapped gulley grating at least eighteen inches distant, and until this regulation is adopted and vigorously carried out we foresee that for a long time to come fresh evidences of its necessity will annually make their appearance.

TRANSACTIONS OF THE EPIDEMIOLOGICAL SOCIETY.

For some years the reports of the Epidemiological Society were issued at irregular intervals, and they failed, in consequence, to provide year by year the information as to current epidemic diseases which was brought before the Society, and much of which could not be obtained elsewhere. But during the last two years a new series of *Transactions* has been issued, the Society publishing a separate volume at the termination of each session. The first two volumes of the series are before us, and a brief summary of the material they contain will go far to show how wide a tract is covered by that which may be properly included in the study of epidemiology, and how many of the subjects dealt with possess an interest in no way limited to those who may be regarded as having made epidemiology a speciality.

The presidential address for the two sessions was given by Dr. Buchanan, F.R.S., who summed up the various aids to epidemiological knowledge which had been rendered by mathematics, by physics, by micro-pathology, and other kindred sciences; examples being given as to the need for co-operation with every other science in the study of epidemiology; and this paper was appropriately followed by one in which a history is given of the progress of zymotic micro-pathology up to recent date. The sanitary conditions existing in our Indian empire, and the special considerations which attach to local epidemics and outbreaks of disease peculiar to the Indian climate and populations, have always formed an important portion of the work done by the Society, and the volumes under consideration show that no exception has been made in

this respect during recent years. Sir Joseph Fayrer discusses the old and still unanswered question—What is the precise meaning of malaria? The influence of the climate of Indian hill sanatoria in cases of scrofula, tuberculosis, and phthisis, forms the subject of a very exhaustive paper by Surgeon-General Joseph Ewart, M.D., and the same author treats of the causes of excessive mortality among women and children of European soldiers serving in India. Surgeon-General De Renzy, C.B., deals with the sanitary state of the British troops in Northern India, and gives proof, which is supported by tables and other references, making clear to all but prejudiced observers that many of the infectious diseases of India, and especially typhoid fever, are due to much the same sanitary defects as are associated with similar prevalences in this country. The history and symptoms of the Delhi sore are fully given by Surgeon-General Murray, whose paper is illustrated by a series of photographs. Surgeon-General Cuningham, the Sanitary Commissioner with the Government of India, discusses the sanitary lessons of Indian epidemics, and his paper is interesting as showing the views which are taken by what we believe has now come to constitute a minority only of Indian observers. With many of Dr. Cuningham's views we cannot agree, and we are inclined to believe that the main reason why he falls into serious error, especially as to the causation of several of the diseases to which he refers, and notably as to cholera and enteric fever, is that instead of studying small outbreaks, occurring in localities where it would be possible to eliminate sources of error, he holds that undue importance is attached to exhaustive enquiry in connexion with local outbreaks, and he prefers giving consideration to what he terms facts extending over a large area; a method of enquiry which compels him to fall back for his data upon a large number of observers scattered over a wide area; and often using the same or very similar terms to describe conditions which materially differ from each other.

The first of the two new volumes contains what is probably the most complete account of the filaria sanguinis hominis as yet published, the subject being dealt with from different points of view by three separate authors. In the first place Dr. Spencer Cobbold, F.R.S., gives a paper on filariæ and other parasites in

relation to endemics and epizoötics, entering in detail into the right interpretation of the mode of action of filariæ, hæmatozoa of all kinds, and micro-parasites generally in the production of diseased states. Dr. Wykeham Myers, of Formosa, follows with a somewhat similar paper ; details of cases being given, together with the results of microscopic examinations of the blood of patients at various stages. And lastly, Dr. Prospero Sonsino, of Pisa, contributes a communication on filaria sanguinis hominis, lymphocele, lymphuria, and other associated morbid disorders, which contains information as to the microscopical and chemical characters of lymphous urine, as to the differences between filarious hæmato-lymphuria, bilharzia hæmaturia, and other disorders of the urine, and as to the co-existence of filaria and bilharzia, and the relative frequency of these and other worms in Egypt, the country in which Dr. Sonsino's labours in connexion with this subject were mainly carried out.

The epidemiology of our own country is, however, by no means neglected. The etiology of diphtheria, and the question whether the infection can be conveyed by means of the wind, are points discussed by Dr. Airy, who gives details as to epidemics, the circumstances of which have led him to believe in the probability of such a method of conveyance. The force of the "epidemic wave" and some of its probable causes, is the subject of a thoughtful paper by Dr. Arthur Ransome. Dr. Longstaff, who illustrates his paper by carefully-prepared diagrammatic tables, supplies statistical and other information with a view of aiding in the solution of the question, whether phthisis, bronchitis, and pneumonia are to be regarded as epidemic diseases. The policy and practice of Glasgow in the management of epidemics is explained by Dr. J. B. Russell, whose contribution on this subject is well worthy of study by all sanitary officials and others interested in the promotion of public health. Dr. Norman Chevers, who approaches his topic both as antiquarian and physician, takes an interesting "glance" at the sanitary defects of the site of London and its environs, tracing the history of our metropolis with its various extensions, and the sanitary circumstances connected with its growth, from the days when the Celtic and the Roman leaders first took those steps which decided the position of London.

The second volume brings the question of the construction and use of hospitals for infectious diseases up to current date by means of a paper which is well illustrated with lithographic plates, by Mr. Gordon Smith, Architect to the Local Government Board; and by a short account by Mr. G. W. Collins, giving his experience of the use of hospital tents in the treatment of small-pox during an epidemic of that disease at Wednesbury. The same volume also contains a paper by Dr. Seaton, Medical Officer of Health for the Borough of Nottingham, on the influence of small-pox hospitals. Nottingham during 1881-82 suffered from a severe epidemic of this disease, and a large number of cases were aggregated in a small-pox hospital situated in the centre of the town. At very great pains Dr. Seaton investigated the circumstances of minor outbreaks which occurred round about, and at different distances from the hospital, and he comes to the conclusion that such outbreaks were in the main, if not solely, due to personal infection from badly isolated cases. The importance of the paper lies in the circumstance that it appears at first sight to disprove the possibility of small-pox hospitals having an influence for evil by means of an aërial distribution of the infection. But admitting all that Dr. Seaton urges as to the special groups of cases he investigated, the fact that the contagium of small-pox may at times be distributed by means of the atmosphere is by no means disproved. It is daily being so conveyed for short distances, and all that those who hold views opposite to those expressed or implied by Dr. Seaton contend for is—that under special meteorological and perhaps other unknown conditions, this aërial diffusion may extend over exceptionally wide areas. From this point of view, and if taken together with Mr. W. H. Power's experience in connexion with Fulham Hospital, the paper is well deserving of critical study.

THE PRACTITIONER.

JUNE, 1884.

Original Communications.

MICRO-ORGANISMS AND DISEASE.

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(*Continued from* p. 352.)

CHAPTER X.

BACILLUS: NON-PATHOGENIC FORMS.

SEPTIC bacilli.

(*a*) *Bacillus subtilis* (hay-bacillus).—The elementary rods are of various lengths from 0·002 to 0·006 mm., and are about 0·002 mm. in thickness. According to Cohn[1] at a temperature of 21° C. division into two requires about one hour and a quarter, at 35° C. only about twenty minutes.

The bacilli are capable of forming leptothrix filaments. The bacilli when single are possessed of one flagellum, or sometimes of two, one at each end. After division the individual bacilli remain connected, each possessing a flagellum at the free end. Each of them divides again into four, so that

[1] *Loc. cit.*

a chain of four is formed, of which only the end members possess a flagellum. But they may separate again or may go on

FIG. 36.—FROM A CULTURE OF BACILLUS SUBTILIS (HAY-BACILLUS).
Various forms between single bacilli and leptothrix.
Magnifying power about 700.

dividing, remaining united, and thus forming a longer or shorter filament. These filaments, as a rule, possess no flagellum at the end.

The bacilli form a dense resistent pellicle on the surface of the nourishing medium, and in this copious spore-formation

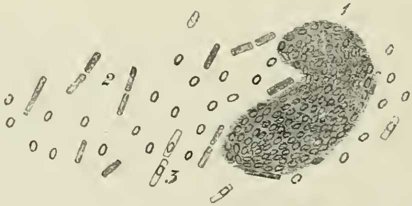

FIG. 37.—FROM A CULTURE OF BACILLUS SUBTILIS (HAY-BACILLUS), WITH COPIOUS FORMATION OF SPORES.

1. Mass of spores embedded in hyaline matrix.
2. Bacilli.
3. Single bacilli containing each a spore: the sheath of the bacilli is well seen.

Magnifying power about 700.

takes place. If shaken when growing in a fluid, the pellicle falls to the bottom, and soon a new pellicle is formed.

Spore-formation is independent of any deficiency of nourishing material. The spores are oval, bright, of about 0·001 to 0·002 mm. in length, and about 0·0006 to 0·001 mm. in thickness. They do not stain in dyes and hence form a great contrast to the bacilli.

This bacillus is very common and widely distributed; it occurs in almost every organic substance rich in nitrogenous compounds which is left exposed to the air to decompose. The best material is hay-infusion. An infusion, cold or hot, of hay is made in a beaker or flask; the fluid is filtered, covered with a glass plate, and left to stand in a warm place. After a day or two it swarms with bacillus subtilis, which is also called hay-bacillus, since ordinary hay contains multitudes of its spores. For this reason even boiling of the fresh infusion for a few minutes does not sterilise it.

Fig. 38.—Germination of Spores into Bacilli.

a. Spores of a small kind.
b. Spores of a larger kind of bacillus subtilis.
Magnifying power about 700.

The bacillus grows well in every fluid that contains the necessary salts and nitrogenous compounds; thus all kinds of broth, all kinds of animal fluids (hydrocele, blood-serum, &c.), gelatine, peptone solution, &c., are suitable nourishing media.

The spores of the hay-bacillus are widely distributed in the air, and most contaminations by air are due to its spores.

(*b*) *Bacillus ulna.*—By this name[1] Cohn designates certain species of bacilli, stiffer and thicker than those of bacillus subtilis. The individual elements are about 0·01 mm. long and 0·002 mm. thick. They are motile just like bacillus subtilis. Although they form chains they do not form proper leptothrix. They occur in putrid fluid. They are very common in the ichor produced by injecting ammonia or other substances

[1] *Loc. cit.* p. 177.

producing sloughing and necrosis of the subcutaneous tissue in the guinea-pig.

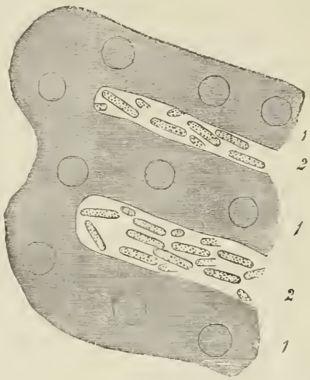

Fig. 39.—Bacillus ulna, in the Capillaries of the Human Liver. Post-mortem change.
1. Liver cells, somewhat swollen.
2. Bacilli.
Magnifying power 300.

(c) *Bacillus septicus* occurs in earth, in putrid blood, and in many putrid albuminous fluids. It is non-motile, and is capable of forming leptothrix. The thickness varies from 0·004 to 0·01 mm., and its length depends on the number of elements contained in a row. The shortest are about 0·004 mm. There are various species, differing from one another in the thickness of the elements. They are all anaërobic. The elements, whether in the short rods or in the leptothrix filaments, are cubical or rounded. The rods and filaments are markedly rounded on the ends. It forms spores independently of free access of air. The spores are oval, and differ in thickness according to the thickness of the bacilli they are formed in. The bacillus is found occasionally in the blood-vessels of man and animals after death. In a nourishing fluid, in which micrococcus, bacterium termo, or bacillus subtilis grows, they have no chance of growing, and even when numerous at first they soon disappear.

(d) *Streptothrix* and *Cladothrix*.—Cohn[1] found in a concretion of the human lacrimal canals long, pale, smooth, apparently branched threads, either straight or twisted; they were finer than the threads of leptothrix buccalis; he called them *Streptothrix Foersteri*. They are probably identical morpho-

[1] *Beitr. z. Biol. d. Pflanzen*, vol. i. p. 186.

logically with *Cladothrix dichotoma*. This latter occurs in pond-water containing decomposing organic matter. It consists of

FIG. 40.—STREPTOTHRIX FOERSTERI, AFTER COHN.

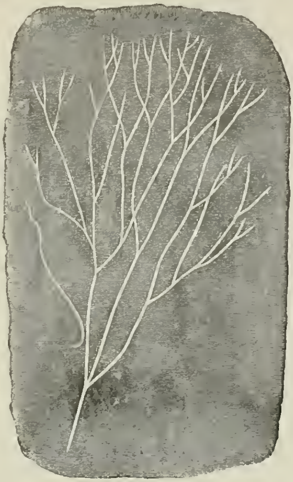

FIG. 41.—CLADOTHRIX DICHOTOMA, AFTER COHN.

long whitish threads fixed on chlorophyll-containing algæ. The threads when fresh appear smooth, pale, occasionally granular, and on staining they are seen to be composed of shorter or longer bacilli just like the leptothrix form of bacillus subtilis; but they are thicker than the bacillus subtilis. Occasionally the ends of the threads are seen not as linear series of bacillar rods, but like bacillus anthracis and the bacillus of blue milk (see below) as chains of torula-like spherical elements. From the threads single motile bacilli are seen to come off. The threads are only apparently branched, since the branches are threads merely stuck on to other threads sideways at an acute angle. A bacillus may be seen to stick to a thread and then to grow out by continuous divisions into a long chain of bacilli, thus forming, as it were, a side-branch. Some of the threads are wavy and curved; most of them are, however, straight. Zopf[1] claims to have observed that the threads of the cladothrix gave rise to micrococcus, bacterium, bacillus, and spirillum; and states that each of these is again capable of growing into

[1] *Zur Morphologie der Spaltpflanzen*, Leipzig, 1882; see also Cienkowski.

the threads of the cladothrix. But these observations were not made after exact methods.

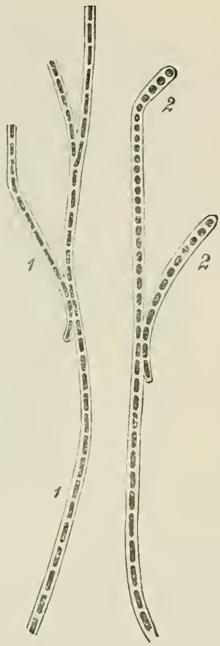

FIG. 42.—THREADS OF CLADOTHRIX DICHOTOMA HIGHLY MAGNIFIED AND STAINED WITH SPILLER'S PURPLE.
1. Threads of bacilli.
2. Torula forms.
The sheath is everywhere well seen.

Zymogenic bacilli.

Amongst these there is one species definitely known, namely, the *Bacillus butyricus* (*Bacillus amylobacter*,[1] *Clostridium butyricum*, *ferment butyrique*, Pasteur). This bacillus has the same morphological characters as regards length and thickness of the rods, as regards power to form leptothrix, and as regards motility, as the bacillus subtilis. It is capable of forming zooglœa, and is anaërobic, since it grows well and forms spores copiously even when not exposed to the air. After the rods have gone on dividing and forming chains and filaments for some time, they swell up, become granular and oval with

[1] Prazmowski, Leipzig, 1880; van Tieghem, *Bull. de la Soc. botanique*, vol. xxiv. 1877.

more or less pointed ends, and the formation of oval spores sets in. In this state the oval rods are about 0·002 to 0·003 mm. thick, and the spores are about 0·002 to 0·003 mm. long and 0·001 mm. thick. In solutions of starch, dextrin, and sugar the bacillus forms butyric acid. The fermentation of butyric acid

Fig. 43.—Clostridium butyricum or Bacillus butyricus. Some of the spindle-shaped forms include an oval spore.

in old milk and ripening cheese is due to this bacillus. Cellulose is decomposed by it, and hence its great importance in the digestive process of herbivorous animals, in whose stomach and intestine it is very common. It is very common also in substances containing starch.

Iodine produces a characteristic blue staining in the protoplasm of the bacillus. In young rods the colour produced by iodine is blue, in older rods it is violet.

E. Kern described (*Biolog. Centralbl.* ii. p. 135) a bacillus under the name of dispora caucasica, which he found in the Caucasus, and used as ferment to produce from cow's milk a peculiar drink, called "kephir" or "hyppö." The bacillus is similar to the bacillus subtilis, but is distinguished from it and all other bacilli by this, that every bacillus forms two spores, one at each end, hence the name dispora.

Pigment bacilli.

(*a*) *Bacillus ruber.*[1]—This appears as minute rods, isolated or in twos and fours, and motile. It was found on boiled rice by Frank. Its colour is red, and contained in the bacilli themselves.

(*b*) *Bacillus erythrosporus.*—Motile, isolated rods and leptothrix. It was found in meat extract solutions and on de-

[1] Cohn, Frank, *Beitr. z. Biol. d. Pflanzen*, vol. iii. p. 181.

composing albumen, and forms pellicles. In the rods are found oval spores.[1]

(*c*) *Bacillus syncyanus* (Neelsen) causes the blue colour of milk after the milk has become acid, and grows well in ammonium lactate. It consists of motile rods, single or in short chains. Neelsen[2] saw the bacilli assuming a torula-form,

FIG. 44. BACILLUS SYNCYANUS, AFTER NEELSEN.
1. Typical bacilli, motile.
2. Non-motile rods invested in a gelatinous capsule.
3 and 4. Bacilli in which spore-formation is going on.
5. Torula-form of the bacillus.

the individual cells being hourglass-shaped or oval, or even spherical (compare *Bacillus anthracis*, Chapter XI.). The rods appear also as a non-motile variety, and are then found to be invested with a thick hyaline gelatinous envelope. The rods form bright oval spores, being at the same time swollen up and ovoid. In Cohn's nourishing fluid they are capable of forming leptothrix, in which occur here and there huge spherical or oval swellings, which, according to Neelsen, probably represent gonidia.

[1] Cohn and Miflet, *Beitr. z. Biol. d. Pflanzen*, vol. iii. p. 128.
[2] *Beitr. z. Biol. d. Pflanzen*, vol. iii. p. 187.

CHAPTER XI.

BACILLUS: PATHOGENIC FORMS.

Pathogenic bacilli.[1]

(*a*) *Bacillus of septicæmia of mice* (Koch).—By inoculating ordinary house mice with minute quantities of putrid fluids, Koch found that occasionally one or another of these animals showed signs of conjunctivitis and sopor, and finally death followed in about forty to sixty hours. In these cases slight œdema is found at the seat of inoculation; the spleen is large; in the

FIG. 45.—FROM A SECTION THROUGH THE LUNG OF A MOUSE DEAD OF KOCH'S SEPTICÆMIA.

1. Small vessel filled with blood; the white blood-corpuscles are filled with very minute bacilli.
2. Interalveolar tissue: in it a white corpuscle filled with the bacilli. Magnifying power 700.
3. A white blood corpuscle more highly magnified, 1000.

(Stained with magenta.)

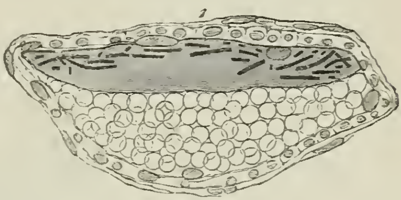

FIG. 46.—FROM A SECTION THROUGH THE SMALL INTESTINE OF A MOUSE DEAD OF SEPTICÆMIA.

The figure represents a section through a small vein in the submucous tissue, filled with blood. At 1, there is a homogeneous substance and in it numerous bacilli, but these bacilli are much larger than the bacilli of Koch's septicæmia in the mouse.

Magnifying power about 700. (Stained with methylene blue and vesuvin.)

œdematous tissue and in the blood-vessels, large and small, numbers of minute bacilli are found, chiefly contained in the white

[1] What has been said of the micrococci associated with open wounds and abscesses applies also to bacilli; *i.e.* there are often bacilli present in the secretions of open wounds, and in the tissue of the base of ulcers; and as the inflammation spreads, so also do the bacilli gradually invade the surrounding tissues. To mention one series of cases only, in ulcerations and in inflammations of the mucous membrane of the stomach and intestine, large numbers of bacilli are occasionally found on the surface of the inflamed parts, and gradually invading the inflamed tissue. Von Recklinghausen (*Virchow's Archiv*, vol. xxx.), von Wahl (*ibidem*, vol. xli.), saw minute pustular nodules in the inflamed gastric mucous membrane which were full of bacilli. Whether the presence and growth of these bacilli was the primary cause or only a concomitant symptom (due, for example, to the loss of active vitality of the tissue) remains to be proved.

blood-corpuscles, but also free. They are very minute, about 0·0008 to 0·001 mm. long, 0·0001 to 0·0002 mm. thick, isolated or in couples, or in chains of four or more. The smallest quantity of this blood invariably kills, with the same symptoms, house mice and sparrows, but not field mice. Rabbits inoculated with these bacilli in the skin of the ear or the cornea show only a local inflammation, and the tissues presently contain numerous bacilli of the same kind. Such animals, after the local effect has passed off, are protected against any further attack by the same bacilli. Koch cultivated these bacilli artificially on mixtures of aqueous humour and gelatine, of gelatine and peptone (1 per cent.), salt (0·6 per cent. NaCl), and sodium phosphate in sufficient quantity to produce a just alkaline reaction. The bacilli grow well on this mixture, and by repeated and rapid division form peculiar branched series.

FIG. 47.—FROM A SECTION THROUGH THE MESENTERIC GLAND OF MAN DEAD OF SEPTICÆMIA.
1. A blood-vessel which at one place is distended by and filled with minute bacilli.
2. Lymph-corpuscles.
3. Degenerated lymph-corpuscles.
Magnifying power 700. (Stained with gentian violet.)

(*b*) *Bacillus of septicæmia of man.*—In several cases of human septicæmia I have found in the blood-vessels of the swollen mesen-

teric glands large numbers of minute bacilli, slightly thicker than those just mentioned. They form continuous masses, both in the capillaries and in the minute veins, amounting in some cases to veritable emboli. They occur isolated or in short chains, their length about 0·001 to 0·0015 mm., their thickness about 0·0003 to 0·0005 mm. Arloing and Chauveau (mentioned in the *British Medical Journal*, Jan. 12, 1884) found in gangrenous septicæmia around wounds short bacilli, some containing one or two spores, which they consider as the true cause of the gangrene. They are destroyed when fresh by a temperature varying between 90° and 100° C.; after drying a temperature of 120° C. is required.

(*c*) *Bacillus of typhoid fever of man.*—Klebs[1] described in the inflamed Peyer's glands, in the mesenteric glands, larynx, and lungs of patients dead of typhoid fever certain bacilli, which are about 0·0002 mm. thick and of various lengths, forming filaments up to 0·05 mm. long. These bacilli form spores. Eberth[2] found in

FIG. 48.—FROM A SECTION THROUGH THE MESENTERIC GLAND OF A PERSON WHO DIED OF TYPHOID FEVER.

1. Capillary blood-vessel filled with blood-corpuscles.
2. Large lymph-cell.
3. Nuclei.
4. The bacilli.

Magnifying power 700.

about 50 per cent. of cases of patients dead of typhoid fever, in the mesenteric glands and spleen, peculiar short bacilli, rounded at their ends, and occasionally slightly constricted in the middle; some of them contained spores. The bacilli stain very freely with

[1] *Archiv f. exp. Path.* vol. xii.

[2] *Virchow's Archiv*, vols. lxxxiii., lxxxvii. See also Koch, *Mittheil. a.d.k. Gesundheitsamte*, i. 1881; and Gaffky, *ibid.* 1882.

methyl-violet. It is, however, doubtful whether these bacilli can be considered as necessarily and intimately connected with typhoid fever, seeing that they are not constant, and only occur in the mesenteric glands and spleen, *i.e.*, in localities into which an immigration of putrefactive bacilli from the bowels may easily take place; especially when we remember that in cases of typhoid fever that end fatally there constantly occur severe sloughing and necrosis of the mucous membrane of the Peyer's glands. The bowels in typhoid fever always contain innumerable masses of micrococci in colonies; and these micrococci are found not only in the tissue of the intestinal mucous membrane but also in the mesenteric glands and spleen.[1]

(*d*) *Bacillus of choleraic diarrhœa from meat-poisoning.*—In July, 1880,[2] there occurred in Welbeck, Notts, an extensive outbreak of diarrhœa among over seventy-two persons who had partaken of beef and ham sandwiches sold at Welbeck on the occasion of a sale of timber and machinery on the estate of the Duke of Portland. The infection showed itself after an incubation-period varying from twelve hours or less to forty-eight hours or more. The first symptoms were a sudden feeling of languor, nausea, griping in the abdomen, in some cases giddiness and fainting, and pain in the trunk. Then followed pain in the abdomen, diarrhœa, and vomiting, the diarrhœa being most constant. Four cases ended fatally. On *post-mortem* examination enteritis and pneumonia were most prominent. Part of the kidney was examined in microscopic sections, and it was found that many of the tubuli uriniferi contained hyaline casts; that the capillaries of the glomeruli of the Malpighian corpuscles, and the afferent arterioles, contained numbers of bacilli, some of the capillaries being distended by and plugged with masses of bacilli densely aggregated. In February, 1881, a similar but less extensive outbreak occurred at Nottingham, among fifteen persons that had partaken of certain baked pork. The symptoms were similar to those in the Welbeck outbreak. One case ended

[1] Klein, *Reports of the Medical Officer of the Privy Council*, 1875.

[2] Report by Dr. Ballard in the *Reports of the Medical Officer of the Local Government Board*, 1880.

fatally. *Post-mortem:* bloody exudation in pericardium, intense pneumonia, mesenteric glands enlarged, enteritis, Peyer's glands

FIG. 49.—FROM A SECTION THROUGH THE KIDNEY OF A CASE THAT DIED AFTER MEAT-POISONING AT WELBECK.

The figure represents part of a glomerulus of a Malpighian corpuscle, in which some of the capillary blood-vessels are filled with the bacilli. Magnifying power 700.

1. Capsule of Malpighian corpuscle.
2. Capillaries filled with bacilli.
3. Capillaries empty.
4. Bacilli contained between capillaries.

enlarged. Bacilli similar to those of the above case were found in the blood, in the pericardial exudation, in the juice and in

FIG. 50.—ISOLATED BACILLI IN A SMALL ARTERY OF THE SAME KIDNEY AS IN PRECEDING FIGURE.

Some bacilli contain spores.

the bloody fluid filling the alveolar cavities of the inflamed lung, in the vessels of the kidney, in the submucosa of the inflamed

Peyer's glands of the small intestine, in the blood-vessels of the spleen and around them.

The bacilli vary in length between 0·003 and 0·009 mm.; their thickness is about 0·0013 mm. They are rounded at their extremities, single or in chains of two, and some contain a bright oval spore, situated in the centre or at one end, and about 0·001 mm. thick. This was the case with the bacilli in the glomeruli of the kidney of the Welbeck case. The bacilli containing spores were thicker than those without them.

Experiments by feeding and inoculation made on dogs and cats, rabbits, guinea-pigs, and mice, with the ham that had done the mischief in the Welbeck case produced positive results. In all cases we found pneumonia and hæmorrhage in the liver, peritonitis in some, spleen enlarged in most. The bacilli found in this ham were cultivated in the incubator in white of egg, and after two days' cultivation four white rats, and several guinea-pigs and white mice were inoculated, and they became ill after twenty-four hours; they were quiet, did not feed well, and were more or less soporous. When killed the spleen was found enlarged, and in the lungs were found hæmorrhage and hyperæmia, and in some cases extensive pneumonia.

Blood, pericardial exudation, and lung juice from the fatal Nottingham case inoculated into ten animals (guinea-pigs and white mice) produced fatal results in six, the other four were killed; but in all there was severe pneumonia, in eight out of the ten there was peritonitis, in four also pleuritis, and in two in addition enlargement of the liver and spleen. Bacilli were found in the blood and exudations of these animals. On cultivating blood and lung juice from the above case, a crop of bacilli was produced, which on inoculation proved very poisonous in the same way as in the previous cases.[1]

(*c*) *Bacillus malariæ.*—Klebs and Tommasi-Crudeli[2] described a bacillus occurring in the soil of the Roman Campagna, which they cultivated on gelatine. The rods are about 0·002 to 0·007 mm. long; they grow in cultures into long leptothrix filaments composed of short joints. The rods form spores either in the

[1] Compare also Huber, *Archiv f. klin. Med.* xxv.
[2] *Archiv f. exp. Path.* vol. xi.

centre or at their ends. They grow well also in other media, *e.g.*, albumen, urine, and glue. They require oxygen for their growth, and are therefore aërobic. According to Marchiafava,[1] they occur also in the blood of patients suffering from malaria. Inoculations of rabbits with the cultivated or original bacilli produced a febrile disorder, which Klebs and Tommasi-Crudeli consider analogous to the human intermittent fever; but experiments made by Sternberg with material derived from the soil of malarious localities in America did not bear this out. The febrile disorder had nothing of the character of human intermittent fever, and besides, could be produced by other bacilli than those of malarious soil.

(*f*) *Bacillus of ulcerative stomatitis in the calf.*—In the *Lancet* of May, 1883, A. Lingard and E. Batt described peculiar bacilli in ulcerations occurring on the tongue and buccal mucous membrane of the calf. "The typical ulcer in advanced cases consists of a sore with free overhanging edges. On section through the sore the tongue is found necrosed to a considerable depth." "Whenever the sore touches any other part of the mouth or cheek, the disease is communicated and rapidly spreads. In some cases similar necrotic changes had taken place in the lung. The line of junction of the necrotic with the healthy tissues was found to be occupied by a dense mass of bacilli having the appearance of a dense phalanx advancing upon the healthy tissues. The disease has been proved capable of transmission (to the rabbit and mouse) by injection of the bacilli in question, which are equally numerous and virulent after passing through several generations by inoculation."

The disease often ends fatally in calves.

The best method of staining the bacilli was found to be this: The sections, both those prepared from the ulcerations of the calf's tongue and from the inoculated tissues of the rabbit, are immersed in a mixture of magenta and methyl-blue, then washed in spirit, and after clarifying in clove-oil are mounted in Canada balsam solution. The bacilli are stained deep pink, the inflamed tissue blue. The bacilli appear as thin rods in rows, thus forming a leptothrix-like growth. In some of the long fila-

[1] *Archiv f. exp Path.* vol. xiii.

ments the individual bacilli are not well shown. The filaments are either straight or more or less curved. The length of the

FIG. 51.—FROM A SECTION THROUGH NECROSED AND ADJOINING INFLAMED PART OF THE EAR OF A RABBIT, INOCULATED WITH MATTER TAKEN FROM ULCERATIVE STOMATITIS OF THE CALF.
1. Necrosed part.
2. Inflamed tissue.
3. Bundles of bacilli.
Magnifying power 700. (Stained with magenta.)

single bacilli varies from 0·004 mm. or less to 0·008 mm. or more; the thickness is about 0·001 mm. Many of them contain spores. In the ear of the rabbit they invade the connective tissue as well as the cartilage over the whole extent of the ulceration and its neighbourhood. Mr. Lingard found the same bacilli, having the same arrangement, in a case of noma in the human subject.

(*g*) *Bacillus of glanders.*—In 1882 Schütz and Löffler[1] ascertained the occurrence of peculiar bacilli in the nodules of the nasal mucous membrane and internal organs, such as the lung, spleen, and liver, of horses dead or dying from glanders. These bacilli are very minute, being of about the size of tubercle-bacilli (see below), and are

[1] *Deutsche med. Wochenschrift*, 52, 1882.

brought out by staining the tissues with a concentrated watery solution of methylene-blue, and after this washing with very dilute acetic acid. They succeeded in artificially cultivating the bacilli in the incubator at 38° C., on solid sterilised serum of horses' and sheep's blood, using for the purpose particles (see below,

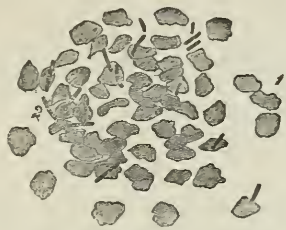

FIG. 52.—PUS OF A PULMONARY ABSCESS IN A HORSE DEAD OF GLANDERS.
1. The nuclei of pus cells.
2. The glanders-bacilli.
Magnifying power 700. (The preparation has been stained with methylene blue.)

under "Tubercle-bacilli") of nodules of the lung and spleen of a horse dead of glanders. After two days (*i.e.* on the third day) there appeared on the surface of the inoculated material the first traces of the growth in the form of minute transparent droplets which consisted entirely of the characteristic bacilli. Cultivating these through several generations or transferences, and then inoculating with them a horse, rabbits, guinea-pigs, and mice, positive results were obtained, especially in the guinea-pigs, which appear very susceptible to the disease. On the site of the subcutaneous inoculation appears an ulcer with indurated base, speedily enlarging and spreading; other ulcers follow in the neighbourhood, the neighbouring lymphatic glands become swollen, and the general infection follows, in the form of nodules and ulcers on the nasal septum, and nodules in the internal organs. In the guinea-pig a characteristic tumour of the testis, ovary, and vulva is often observed. In all these cases the diseased tissues and organs contained the characteristic bacilli.[1]

(*h*) *Bacillus of swine plague.*—In a report to the medical officer of the Local Government Board for 1877-1878, I have shown that in this acute infectious disease the affected organs

[1] Other writers on the bacilli of glanders are Drs. Bouchard, Capitan, Charvin, in the *Revue médicale française*, Dec. 30, 1882; N. P. Wassilieff, in *Deutsche med. Woch.* 11, 1883, observed the bacilli in human glanders.

contain a form of bacterium in morphological respects identical with bacillus subtilis, *i.e.* consisting of longer or shorter motile rods, capable of forming spores; further, that artificial cultures of these bacilli cause the disease in pigs after inoculation; and lastly, that mice and rabbits become affected with this disease after inoculation with material directly derived from the diseased organs of the pig or with artificial cultures. Last year Pasteur claimed to have cultivated from the blood of the pig affected with the disease a microbe which is not a bacillus, but a dumb-bell micrococcus. He states that he has produced with these cultures fatal illness in pigeons and rabbits, and has also caused the plague in swine. I have been able to show by new experiments that Pasteur is wrong in all these points. First, I have proved that pigeons are altogether insusceptible to the disease, since inoculations with material directly derived from the diseased organs of the pig dead of swine plague, material which is well known to produce the disease in the pig, mouse, and rabbit, are altogether harmless to pigeons; and similarly cultivations of the true bacteria of swine plague do not affect pigeons in the least. According to Pasteur's statement the pigeons inoculated with his cultures of the dumb-bell micrococcus died with symptoms and with anatomical lesions almost identical with those of the form of septicæmia known as fowl-cholera; and the conclusion is therefore forced upon us that Pasteur's cultures were contaminated with, or contained solely, the organism of this septicæmia. Similarly his rabbits probably died from the same disease, since these animals are exceedingly susceptible to septicæmia.

On examining the diseased tissues of pigs dead of swine plague by the modern methods of aniline staining, I ascertained that all the diseased organs (lungs, intestines, inguinal and bronchial lymph-glands) contain the characteristic bacilli, mostly filling and plugging minute blood-vessels. So do the diseased organs of mice and rabbits (spleen, liver, lung) dead of the disease.

Artificial cultivations made in broth and hydrocele fluid from diseased organs of the pig, mouse, and rabbit, after an incubation of twenty-four hours at temperatures ranging between 30° and 42° C., contain the above rods, which crowd the nourishing fluids,

all being rather short, about 0·002 to 0·003 mm. long, and all possessed of the power of active locomotion, such as is known to be possessed by the septic bacterium termo and bacillus

FIG. 53.—FROM A SECTION THROUGH THE INFLAMED INGUINAL LYMPH-GLAND OF A PIG DEAD OF SWINE PLAGUE.

1. A capillary blood-vessel filled with bacilli.
2. Reticulum of adenoid tissue.
3. A lymph-cell.

Magnifying power 700. (Stained with Spiller's purple.)

subtilis. During the following days of incubation, while the rods multiply, many of them lose their motility, grow longer, up to 0·005 mm. and more, and in some of the longer samples bright spores make their appearance, one spore at one or both ends or sometimes in the centre.

From these cultivations new cultivations may be made and carried on through successive generations, all cultures behaving in the same manner; and in all of them the rods only are present, and show exactly the same changes as in the parent culture.

The smallest droplet of any of these cultivations produces the disease in pigs, mice, and rabbits. The mice and rabbits die with exactly the same appearances and with the same anatomical lesions as when they are inoculated with material directly taken from the diseased organs of a pig dead of swine plague. Those animals generally die on the fifth, sixth, or seventh day, and on *post-mortem* examination show a characteristic swelling of the spleen, a characteristic disease of the liver (chiefly coagulative necrosis of tracts of the liver tissue), and inflammation of the lungs.

Inoculations of suitable sterilised nourishing fluids made from the spleen, liver, and lung of such animals always result in producing a copious crop of the characteristic bacilli, as do those

made with the lung and bronchial glands of pigs dead of swine plague; but from the blood of the pig the cultivations do not as a rule succeed, nor as a rule from the blood of mice; occasionally

FIG. 54.—BLOOD OF FRESH SPLEEN OF A MOUSE THAT DIED OF SWINE PLAGUE.
1. Blood discs.
2. A large nucleus.
3. Groups of minute bacilli.
4. Long bacilli.
5. Dumb-bells of bacilli.
Magnifying power 700. (Stained with gentian violet.)

however, those from the blood of rabbits dead of the disease do succeed.

Quite recently I have ascertained that pigs inoculated with artificial cultures of these rods (started from the pig, mouse, or rabbit dead of the plague) or with the diseased organs of a mouse or rabbit, suffer from a mild form of the disease, which after one or two weeks passes off completely. I have had pigs that had been twice inoculated, the first time with artificial cultures, the second time with diseased organs of mouse and rabbit, and each time the pigs suffered from a mild form of the disease. They were then inoculated a third time with the juice of the diseased (fresh) lung of a pig dead of the plague; this time also they showed distinct symptoms of the disease, but after a few days to a week they completely recovered. If normal (or not previously inoculated) pigs are inoculated with matter from the diseased fresh lung of a pig dead of the plague, they as a rule die from a virulent form of the disease. But in the above case they were protected by previous inoculations, not altogether against a new attack but against a fatal attack.

(*i*) *Bacillus Lepræ.*—Armauer Hansen[1] first ascertained the

[1] *Virchow's Archiv*, vol. lxxix.; and *Quart. Journ. of Micro. Sci.* 1880.

existence of large numbers of minute bacilli in the peculiar large leprosy-cells of Virchow, which occur in the nodules of

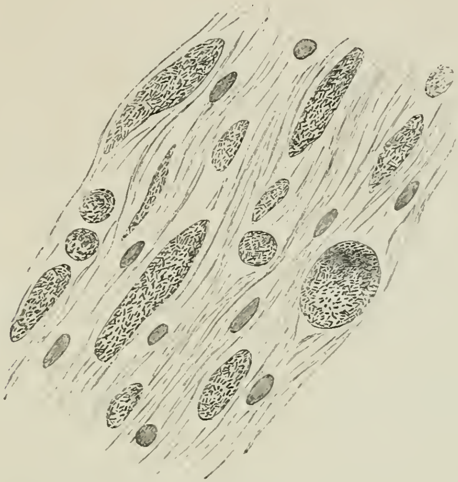

FIG. 55.—FROM A SECTION THROUGH THE LARYNX OF A PATIENT DEAD OF LEPROSY. Huge cells in fibrous connective tissue; the cells are filled with the leprosy bacilli. Magnifying power 600. (Stained with magenta and vesuvin.)

leprous patients. Neisser confirmed this, and considerably extended our knowledge of the bacilli, showing that they can be

FIG. 56.—BACILLI OF THE SAME PREPARATION AS IN PRECEDING FIGURE. More highly magnified, 1000.

readily stained pink with fuchsin or with Ehrlich's acid solution of eosin-hæmatoxylin. The bacilli are fine rods about 0·004 to

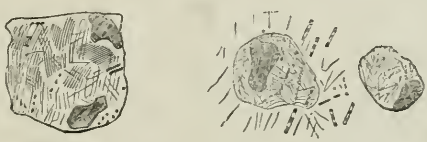

FIG. 57.—CELLS OF THE LEPROSY NODULES OF MAN, FILLED WITH THE LEPROSY BACILLI, AFTER NEISSER.

0·006 mm. long and less than 0·001 mm. thick. They are pointed at their ends, and always occur in masses within the large leprosy-

cells of the leprous tubercles of the skin and internal organs. But they are also present in the interstitial tissue of the nervous branches in the anæsthetic variety of the disease.[1] Some bacilli are motile, others not; some possess bright oval spores, and others are more or less beaded, owing to local collections of the protoplasm within their sheath. Neisser and Armauer Hansen have cultivated them artificially in blood-serum and in solutions of meat-extract. Neisser has also shown that the characteristic leprosy-cells are only wandering cells modified by the growth and multiplication in them of the bacilli. In the blood the bacilli do not occur, but they spread probably only by way of the lymphatics.

Inoculation experiments on domestic animals and monkeys have hitherto failed.[2] Damsch [3] maintains, however, that he was able, by inoculation with leprous tissue into the peritoneal cavity and into the skin, to produce in cats a distinct increase and sprouting of the bacilli. Preparations of leprous nodules of the larynx and skin made by my friend, Mr. A. Lingard, and stained with Weigert's solution of magenta and vesuvin, showed the leprosy-bacilli completely filling all the cells, small and large, spherical and spindle-shaped, contained between the connective-tissue bundles.

In a section through the liver of a bird (*Rhea*) that died in the Zoological Gardens in London, prepared by Dr. Gibbes after his method of staining for tubercle-bacilli, there were seen innumerable aggregations of larger and smaller pink masses (visible to the unaided eye as dots of the size of a pin's point to that of a pin's head or millet seed, and larger). Under the microscope these pink masses were seen to be composed of cells of various sizes, each filled with an enormous number of what appeared under a high power very short bacilli, much shorter than tubercle-bacilli. But they gave the same reaction as tubercle-bacilli. Here and there isolated cells of various sizes could be seen filled with the bacilli. In the large cells the cell-outline was becoming indistinct, and in some the cell-substance

[1] Compare also Cornil, *Union médicale*, 1881, Nos. 178, 179, and Babes, *Archives d. Physiologie*, July, 1883.

[2] Köbner, *Virchow's Archiv*, vol. lxxxviii.; Hansen, *ibidem*, vol. xc.

[3] *Virchow's Archiv*, vol. xcii.

was seen to break down, whereby the bacilli became free. In these respects, in the size, distribution, and character of the

FIG. 58.—TWO CELLS OF THE LEPROSY (?) NODULES IN THE LIVER OF A BIRD (RHEA). The cell-subtance is crowded with minute bacilli, similar to leprosy-bacilli. Magnifying power 700. (Stained with magenta.)

bacilli, there exists a remarkable similarity between the nodules in leprosy and the nodules just mentioned.

(*j*) *Bacillus of malignant œdema* (Koch), *vibrion septique* (Pasteur). By inoculating mice, rabbits, and especially guinea-pigs subcutaneously with a comparatively large quantity of earth, or of putrid fluid, one occasionally produces death in twenty-four to forty-eight hours. This form of septicæmia is also called "Pasteur's septicæmia," and is of course distinct and different from Davaine's septicæmia.[1] At the seat of the inoculation and spreading from it into the subcutaneous tissue of adjoining parts there is much discoloration and occasionally hæmorrhage; a turbid offensively-smelling ichor fills the spaces of the subcutaneous tissue, and in it are found large numbers of bacilli, some motile, others not. The lungs are hyperæmic and have small hæmorrhagic spots. The spleen is invariably enlarged and hæmorrhagic spots are often noticed on the peritoneum of the abdominal organs, and there is some peritoneal exudation. The blood of the spleen, of the liver, lung, and intestine, the serous coating of the abdominal organs, and the peritoneal exudation, contain the same bacilli as the subcutaneous exudation. Many of them include spores. By injecting the bacillus

[1] Rosenberger maintains (*Centralblatt f. d. med. Wiss.* 4, 1883) that the blood and exudation-fluids of rabbits dead of Davaine's or Pasteur's septicæmia can be effectually sterilised by heat without losing their specific action, reproducing on injection into fresh animals the disease with the recurrence of the organisms characteristic of the disease. Dowdeswell, however, states (*Proceedings of the Royal Society*, 221, 1882) that this is not the case, for on really effectual sterilisation by heat the organisms are killed, and the fluids become innocuous.

into the peritoneal cavity of guinea-pigs death is produced rapidly, especially after passing it through two generations, so rapidly indeed that the animals often die within sixteen hours (Burdon Sanderson and Klein). In all these instances a viscid transparent slightly but spontaneously coagulable exudation, poor in white and red corpuscles, is found in the peritoneal cavity, and the peritoneum of all parts is highly inflamed. Bacilli are present in it in enormous numbers, many of them containing spores. The blood of the heart does not contain bacilli immediately after death, but has them some hours after.

The bacilli in question are about 0·003 to 0·005 mm. long and a little over 0·001 mm. thick; they are rounded at their ends; they form chains of two and more, and these chains are

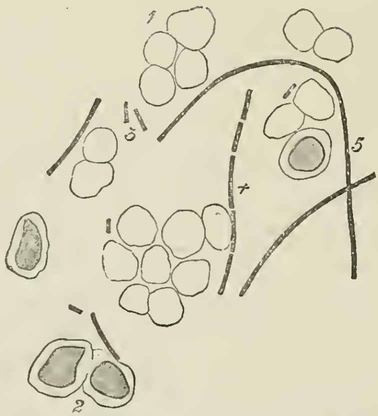

FIG. 59.—BLOOD OF A GUINEA-PIG DEAD OF KOCH'S MALIGNANT ŒDEMA.
1. Red blood discs.
2. White corpuscles.
3. Single bacilli.
4. Chain of long bacilli.
5. Leptothrix.
Magnifying power 700. (Stained with gentian violet.)

straight or broken. They also form leptothrix, straight or more commonly curved. The bacilli have been artificially cultivated by Pasteur [1] in blood-serum and in neutral solution of Liebig's meat extract. Gaffky [2] grew them on potatoes at 38° C. The artificial culture is capable of producing the malignant œdema, but it is always necessary to inject more than minimal

[1] *Bull. de l'Acad.* 1877. [2] *Mittheil. a. d. k. Gesundh.* 1880.

quantities. The bacilli grown in fluids outside and inside the body form spores without free supply of air, and are therefore anaërobic (Pasteur).

In human fæcal matter there are always present innumerable masses of bacteria—micrococci, single and in dumb-bells, and in clumps of zooglœa, bacterium termo, and various species of bacilli, varying in thickness, length, and in motility, some being motile, others not. It has recently been stated that a bacillus can be cultivated from normal human fæces which in many respects resembles the bacillus of malignant œdema ; it produces death in mice, but without the symptoms of malignant œdema.

Professor Rossbach has maintained (*Centralblatt f. d. med. Wiss.* 5, 1882) that when a solution of papayotin (the juice of *Carica papaya*) is injected into the veins of a rabbit, the animal dies, and shortly after death—even so short a time as fifty minutes after the injection—there are found in the blood large numbers of bacteria. Dowdeswell, however, states (*Practitioner*, May, 1883) that solutions of papayotin contain as a rule the spores of a motile bacillus which in all respects resembles bacillus subtilis ; in artificial cultures in 10 per cent. solutions of papayotin, in blood-serum, and in broth, these spores develop into bacilli which form leptothrix filaments, and in them spores soon make their appearance. Filtered papayotin solutions, when injected into the blood of rabbits, kill like unfiltered ones, but neither during life nor after the death of the animals could any organisms be detected in the blood. It appears to follow from these experiments, that papayotin solutions contain spores, and that these spores are those of a bacillus subtilis which does not possess any specific pathogenic properties.

(*k*) *Bacillus of symptomatic anthrax* (Ger. *Rauschbrand ;* Fr. *charbon symptomatique,* Arloing, Cornevin, and Thomas, *Bull. de l'Acad.*, 1881 ; Eng. *black leg, quarter-evil*). This disease, which is not uncommon in cattle, generally ends fatally and is very infectious. It is characterised by hæmorrhagic effusion (or "tumour") in the subcutaneous and inter-muscular tissues of one or other, or both, anterior or posterior extremities, in consequence of which the movements of the animal so affected become greatly impeded. The animals generally die in the course of the second or third day after infection. The subcutaneous tumour contains numerous bacilli, as do the abdominal and thoracic viscera.

The bacilli are about the size of those of malignant anthrax or a little thicker; they are rounded at their ends and often include at one end a bright oval spore ; this is also present in the bacilli of the parenchymatous organs (as will be shown below this never occurs in the bacillus of malignant anthrax). The bacilli are either single or form short chains.

Inoculations with them into the subcutaneous tissue of guinea-pigs, rabbits, sheep, and calves always prove fatal, the same subcutaneous hæmorrhagic effusions being produced.

FIG. 60.—BLOOD OF A GUINEA-PIG DEAD OF SYMPTOMATIC ANTHRAX.
Blood-corpuscles and between them several bacilli.
Magnifying power 700. (Stained with Spiller's purple.)

Injections of small quantities of bacillus-containing material into the veins produces only a slight febrile disorder; large doses produce death. Animals in which by intravenous injection of small doses slight illness has been produced are afterwards protected against the fatal dose. But minimal doses injected subcutaneously also produce only a slight transitory swelling, and the animal so treated is afterwards protected against the fatal dose (Arloing, Cornevin, and Thomas). The spores of the bacilli when heated up to 85° C. for six hours lose their virulence (Arloing, Cornevin, and Thomas).

(*To be continued.*)

ON THE VALUE OF MERCURY IN THE TREATMENT OF PLEURISY.

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THAT mercury is a powerful antiphlogistic few who have had experience of it will deny; but although it is admittedly a weapon of great power, it requires at times singular care and discrimination in its employment. As in blood-letting so with mercury—indiscriminate abuse, with its certain tale of harm, has led to suspicion and distrust. Hence with a large number of the practitioners of to-day the very means which half a century ago cut short and cured many an inflammatory attack, are now, like the memory of those who then employed them, reckoned as of the past.

This paper is written to call attention to the value of mercury in a serous inflammation, which is common in the experience of all.

Twenty years ago, when a clinical clerk with Dr. Warburton Begbie in the Edinburgh Infirmary, I first learnt the value of mercury in pleurisy; but his teaching and his practice were not so emphatic in its favour as my own is now. He gave it rather with a view to favouring the absorption of fluid already effused in the pleural cavity ; my inclination is to administer it with the direct object of cutting short the morbid action of which the effusion is but a product. Let me illustrate this by a clinical example. Some time ago I attended with a brother practitioner a severe and anxious case of pleurisy. The subject of the disease was a thin spare woman of forty. She had married

early, had borne in rapid succession a family of thirteen children, and was at the time of her attack nursing a baby not many weeks old. Overweighted in every way by anxiety and hard work, with a feeble organisation and a highly nervous temperament, the stress of an acute ailment rapidly reduced her to an alarming state. When I saw her first she had been ill for several days; temperature ranged from 101° to 103°·4; pulse small and feeble, nearly 140; respiration short and quick, fully 40 in the minute. Orthopnœa was marked. Examination revealed three-fourths of the right chest dull on percussion, with an almost tympanitic note above; total absence of breath-sounds in the lower third, with bronchial breathing in the upper region of dulness, and with ægophonic voice and considerable depression of the liver. The cardiac sounds were sharp and feeble. She had been treated with aconite, opium, the salts of potassium, quinine, &c., but with no apparent benefit.

With a view of relieving the dyspnœa, paracentesis was at once performed, and nearly forty ounces of fluid were withdrawn. So urgent was her condition and so disappointing had been the treatment that, in spite of her feeble state, mercury was prescribed in the form of blue pill, gr. ij, with squill and digitalis, āā gr. i, night and morning. The stimulant, of which she was already having a small quantity, was increased, and the iodide of potassium administered in small and frequently repeated doses.

As days went on, however, they brought little improvement, the temperature still continued to run high, and the effusion rapidly increased. Within five days paracentesis was again required, and as there was as yet no evidence of mercurial action, the Unguentum Hydrargyri was rubbed rather freely, night and morning, on the inner aspect of the thighs and upper arms. Within forty-eight hours improvement declared itself, the temperature began to fall, the pulse became steadier, the heart-sounds more distinct, and the effusion, which heretofore had steadily been on the increase, rose no higher. The gums were distinctly sore, the odour of the breath was unmistakable, and the occurrence of a greenish diarrhœa proclaimed beyond doubt the fact that the desired influence of mercury had been fully attained. From that date she did uninterruptedly well. With the fall in temperature absorption began, and in a few weeks,

beyond a certain dulness and indistinctness of breath-sounds, she was in very fair health, while her ultimate recovery was complete and perfect. That she owed her life to the beneficent action of mercury neither her medical attendant nor myself had the shadow of a doubt. And if in a case such as this, the subject of which was a broken and feeble woman, in whom acute disease had already induced very pronounced asthenia, one can use with success a drug the debilitating effects of which form in the opinion of many the gravest objection to its employment, the field of its usefulness becomes in my opinion a great and wide one. So truly am I convinced of its value that for very many years I have treated no case of pleurisy without its aid, though the practice is of course founded on far larger experience than my own.

In the May number of the *Practitioner* for 1878 is an able paper by Dr. Thorowgood "On the Use of Mercury in Certain Inflammations," pleurisy being one of them. All he says in its favour I readily indorse, but I venture to differ from him on one point, and that as regards its value in pleurisy even after the pulse has fallen and the temperature become normal. His teaching is that "then absorption of effusion may be looked for and mercurial medicine may be laid aside, while we look to iodine preparations and blisters as the means to help forward the absorbing process." Now it has happened to me repeatedly that after blistering and the free use of such remedies as are known to stimulate absorption, the fluid in the pleural cavity having reached a certain level, often a very low level, has remained without any diminution; then mercury, given in the early days of the case but for a time discontinued, again comes to our aid, and the slight tenderness of gum and fœtor of breath do not mark more certainly its physiological effect than does the rapid disappearance of the effusion. I therefore incline to continue the remedy in minute doses until the effusion has disappeared. Slow in convalescence as such patients may be, worn as they are by a severe and trying malady, I have never yet seen recovery hindered by the careful and guarded use of the remedy; and I believe that in many instances within my personal knowledge the stage of convalescence was reached by its employment.

I am able to testify in like manner to the value of mercury in the meningitis that succeeds injuries to the head, and the peritonitis which so often follows the operation for strangulated hernia, but my intention is here merely to note a lesson which a somewhat considerable experience has taught me in regard to a serous inflammation which is more purely medical.

ERRATUM IN THE MAY NUMBER.

Page 394, line fifteen from top, *for* "mercury falling 3·5," *read,* "mercury falling 0·35."

EPILEPSY TREATED WITH HYDROBROMATE OF CONIA.

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Being frequently disappointed in the action of potassium bromide in the treatment of epilepsy, I have lately been trying a remedy which I believe has not previously been used for this complaint. If the result is not quite so favourable as I might have expected, it is at any rate sufficiently good to warrant further trial, and I venture to place on record the notes of seven cases, in the hope that it may lead to further observations. We have all experienced the failure of potassium bromide until poured in in such quantity that often a condition of bromism is established. The unsightly blotches thus produced are a source of annoyance, especially to the better class of patients, to whom personal appearance is a matter of concern. The following is a summary of my notes.

Case I.—A——, girl, aged eight: ill for two years, with epileptiform seizures consisting of sudden flexions of the fore-arm (right), and a momentary vacantness of look; latterly the attacks had become more severe, culminating in loss of consciousness. Hydrobromate of conia, in doses of half a grain three times a day, was prescribed. During the first week she had six slight "fits." The dose was then increased to five-eighths of a grain, and during the succeeding week she had no attack. The medicine was continued for four weeks, during which time she had no fits at all, and slept better. The drug was then discontinued for some weeks, when she returned for

further treatment. During the adminstration of the drug, this patient complained of constant frontal headache.

Case II.—B——, male, aged twenty-two: suffered from true epileptic fits, with typical aura, convulsions, unconsciousness, and great headache afterwards. One and a half grains of hydrobromate of conia was ordered twice a day; during the week, this patient had nine fits. One and five-eighths grains was now adminstered twice daily for a week. During this time the patient had four bad fits. He was now, at his own request, put under potassium bromide, ʒj doses, three times a day, which kept them under.

Case III.—C——, female, aged thirty-four: had been ill for four years, with one or more fits every week, typically epileptic. While taking potassium bromide they were kept under. I ordered one grain of hydrobromate of conia twice a day to commence with. For a week she was better, with only one slight attack. The dose was increased to one and a quarter grains, and during the next fortnight she had one slight fit. She was then ordered back to bromide.

Case IV.—D——, girl, aged seven: has seven or eight fits a week of typical epileptic character. She has frequent right-sided convulsions, the right arm being suddenly flexed. Sometimes these culminate in a real fit, with insensibility and rigidity. The child is an imbecile.

As while under ʒj doses of bromide, the child still had frequent fits, I ordered one-quarter grain of hydrobromate of conia three times a day. For the first week she had five fits (all occurring the day after the medicine was changed). For the second week, there were seven fits. The drug was increased to half a grain three times daily. For a fortnight she was absolutely free from fits, and then had seven. The drug was continued for some weeks, but she still had fits occurring at irregular intervals, which were refractory to both conia and potassium bromide.

Case V.—E——, female, aged twenty-seven: has typical epileptic fits, which continue under ʒj doses of potassium bromide. I administered half a grain of hydrobromate of conia three times a day. During the next week she had no fits and stated that she felt better, but with frequent headache. For

a month while under this treatment she had no fit, but complained of more frequent headache, in consequence of which I returned to bromide.

Case VI.—F——, male aged eighteen; would have three fits a day, then go for a week without. They were typically epileptic fits. While under large doses of bromide, they were kept under, but not until an unsightly bromide rash was established, which was troublesome to the patient. For the first week, while taking one grain hydrobromate of conia twice daily, he had three fits. For a fortnight longer while under this treatment he had two fits. During the whole three weeks he therefore had five typical epileptic fits. As he stated that the drug made him feel giddy and weak, I returned at his own request to bromide, which so long as he was entirely under its influence in large doses seemed to ward off his attack. It should be stated that this young man was of weak intellect.

Case VII.—G——, female aged fifteen; suffered from true epilepsy, dilated pupils; her optic discs were congested. She had not menstruated and had phthisical symptoms (cough, hæmoptysis, sweating). Half-grain doses of hydrobromate of conia were ordered three times a day. During three weeks she had no fit, which she stated was the longest time she had ever been without. I then lost sight of her.

The conclusions I draw from the treatment of these seven cases, are—that the drug is undoubtedly serviceable in certain cases, and those in which it fails are cases of convulsions depending possibly on some gross lesion of the brain (Cases IV. and VI.). The slighter cases (*e.g.* Cases I. and VII.) were distinctly benefited by it.

The drawbacks to the use of the drug appear in the complaints of headache, and where in large doses, of giddiness lasting for an hour after taking it, with sometimes a suffusion and congestion of the conjunctivæ. In the doses in which I have given it,there has not been noticed any cardiac or respiratory alteration. It is said that the dose of this drug must not exceed four-and-a-half grains in twenty-four hours, commencing with one-and-a-half grains. In my experience a child of eight bore one-and-seven-eighths grains with only headache; a child of seven took one-and-a-half grains per diem, without any complaint:

two-and-a-half grains per diem, were taken by a female without complaint: one adult man took three-and-a-quarter grains with impunity. In one case two grains per diem caused sickness, headache, giddiness, and "weakness" in a young man of eighteen. One-and-a-half to two grains appears to be followed frequently by headache. I think the drug deserves further trial, and I hope to try it more extensively in future. Combined with constant application of the continuous current, I have successfully treated with it a case of hemichorea. In this disease, however, it would be rash to speculate whether the drug, the galvanism, or time was the most effectual in the cure.

POISONING BY POIS D'ACHERY (*PHASEOLUS LUNATUS, LINN.*).

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AND

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THE pois d'Achery (*Phaseolus lunatus, Linn.*) is a species of kidney-bean, cultivated in Mauritius, and used as an occasional article of dietary by the lower class of Creoles. It is well known that some of the varieties of the bean are poisonous. The white beans—for there are two varieties—are generally esteemed wholesome, whilst those that are variegated on the surface are regarded as poisonous. It is not certain, however, whether all varieties are not poisonous at a certain period of their growth, and become either entirely or comparatively innocuous after they are ripe and dried. The average weight of a bean, in its ordinary air-dried condition, is $5\frac{3}{4}$ grains, and they are tolerably uniform in size.

The active agent is hydrocyanic acid, which does not exist ready-formed in the beans, but is formed from them when they are macerated, by a process similar to that by which the same poison is formed from the bitter almond and the cherry-laurel. Doubtless amygdalin, or lauro-cerasin, and emulsin, or similar bodies, are contained in separate cells in the bean, and are brought into contact and react only when the two substances are brought into solution by the agency of the macerating liquid.

The quantity of matter at the disposal of one of us has not

permitted, as yet, of a satisfactory determination of the nature of the body which by splitting up yields hydrocyanic acid. Rather prolonged maceration is requisite to get the full yield of hydrocyanic acid, unless the beans be finely powdered—an operation of no little difficulty on account of their toughness. No alkaloidal body can be detected in them.

The yield of hydrocyanic acid obtained by prolonged maceration does not vary so greatly as might be supposed from the variations in the toxicity of the seeds. The following quantities of the acid were obtained by one of us :—

	HCN per cent.
First Sample.	
Old shrivelled beans	0·270
Non-variegated plump beans	0·135
Variegated beans	0·125 to 0·280
Second Sample.	
Light coloured beans	0·182
Dark „ „	0·249
A mixture	0·105 to 0·146

The average of seven analyses gave 0·250 per cent. of prussic acid.

The symptoms produced by eating the cooked beans differ but little from those ordinarily produced by prussic acid, except in the slowness of their commencement and progress. The mode of cooking must necessarily modify the effects; and if the beans be raised to the boiling point quickly, or if they be subjected to long boiling, either no poison may be formed, or this may be volatilised when formed. The symptoms usually observed are vertigo, headache, nausea, loss of muscular power, trismus, foaming at the mouth, convulsions, loss of consciousness. Pain in the epigastrium, and vomiting—symptoms not ordinarily noted in poisoning by prussic acid—are often prominent.

The following are illustrative cases :—

A man cook, Etienne, gathered and cooked some beans with curry powder and gingeley oil on the evening of April 22nd, 1882. Of this he himself, his wife, and one of his three children partook. He adopted the commonly observed pre-

caution of rejecting the water in which the beans had been boiled before making them into a stew with the curry powder and oil. It was remarked that the stew had a bitter taste. Etienne, however, partook of the beans freely, whilst his wife and child, finding them unpalatable, ate of them more sparingly. Two younger children had none of the stew, but took some of the gravy. The meal was finished at 6.30 p.m., and at 8 p.m. the whole family retired to bed in apparent good health. At midnight the wife was aroused by her husband, who had been seized with nausea and vomiting. He complained of giddiness, and asked for water, but it was with difficulty that he could open his mouth to drink. There was, in fact, commencing trismus. He got up; but on attempting to stand, preparatory to returning to bed, he fell forward; afterwards, with assistance, he succeeded in walking across the room to his bed. The bowels were twice opened, the motions being natural. Nausea continued with epigastric and abdominal pain and frequent retching and vomiting. The vomit contained the beans taken at dinner. After a time there was salivation and foaming at the mouth. The forearms were semi-flexed on the arms, and the legs on the thighs, so that he assumed a crouching attitude, and was in a state of tremor; but it was not noticed whether the limbs were rigid or otherwise. Convulsions set in, accompanied with cold sweats, hurried breathing, and a sense of suffocation. About 2.30 a.m., he became unconscious, and lay moaning. There was now complete trismus, and the mouth could not be opened. He died at 4 a.m., nine and a half hours after taking the beans, and four hours after the well-marked access of symptoms.

Madame Etienne, when awoke by her husband at midnight, felt perfectly well; but about 1 a.m. she began to feel giddy. She complained of pain at the epigastrium, headache, palpitation, and a feeling of suffocation. She vomited frequently and went to stool once, and in doing so observed that there was very marked weakness of the lower extremities. After these symptoms had continued some time, trismus supervened, followed by convulsions and loss of consciousness. She remained unconscious some time, and when she recovered consciousness she still felt very giddy, suffered from palpitation, and vomited several times. After some further time she recovered.

The child that had partaken of the beans was taken ill at 1 a.m. with pain in the stomach. He vomited three or four times and then recovered. Of the two children who had taken the gravy only one vomited several times, and recovered; whilst the other did not appear to be affected.

The cooked beans were found to have a very distinct odour of hydrocyanic acid, and this substance was readily separated from them by distillation.

Autopsy.—The post-mortem examination of the body of the man was made by Dr. Trimiss, twelve hours after death. *Rigor mortis* was present. The stomach contained a few of the beans —among which two were white and entire, and a little grumous liquid. There was no odour of prussic acid; nor could any of this substance be detected on analysis. The mucous membrane of the organ was congested in patches and coated with tenacious mucus. The duodenum was also congested, whilst the rest of the intestinal canal was healthy, and contained semi-fluid yellow fæcal matter. The heart contained a small quantity of dark fluid blood. The lungs, liver, spleen, and kidneys were highly hyperæmic. The cerebral meninges were congested, especially the pia mater; and the cavity of the arachnoid contained some clear serum. The brain substance was normal.

Domini, a female, whose age was not known, dined off a curry of pois d'Achery some time in the afternoon. When her husband returned in the evening he found her well. A little later she complained of nausea, and vomited twice. The vomits contained the undigested beans. She then said she felt better, and returned to bed. Soon after midnight her husband awoke, and found her dead. Several other cases of poisoning by these beans have also occurred in Mauritius.

The above related cases present several points of interest. They illustrate what may be called slow poisoning by prussic acid. In the first series of cases at least four and a half hours elapsed between the ingestion of the beans and the onset of symptoms; and in the case of Domini probably about two and a half hours. Hydrocyanic acid, when taken in simple solution, usually produces symptoms within a very few minutes, and often in a few seconds; and the course is very rapid. Hofmann,

however,[1] speaks of hours occasionally elapsing between the taking of the acid and the manifestation of symptoms. But this statement must be received with hesitation; he cites no cases which support the statement. In the case of poisoning by pois d'Achery—doubtless in consequence of the toughness of the seeds, the slowness with which they imbibe water, and the probability that the fermentable body and the ferment are contained in separate cells—the formation of the poison takes place slowly, so as to allow of elimination of the acid going on to some extent, *pari passu* with its development. In poisoning by bitter almonds it is known that the symptoms are slow in manifesting themselves, and that a fatal termination is much less speedy than when prussic acid or a cyanide is taken in simple solution.

A remarkable feature, noticeable especially in the case of Domini, is the intermittence or at least remittence of the symptoms. This woman was taken ill, vomited twice, then appeared to be well, and at last succumbed to the influence of the poison. The only instance, so far as we know, in which successive mitigations and relapses in the case of poisoning by hydrocyanic acid have been observed is one[2] in which an unknown quantity of bitter almonds had been taken by a boy, aged three years, observed by Dr. Hunt in University College Hospital.

The long continuance of the symptoms is another point worthy of notice. Etienne died after four hours' illness. His wife's recovery was only assured after about eight hours' illness. The repeated acts of vomiting in these cases doubtless cleared the stomach from time to time of the poison: and then a fresh quantity of this was generated. Possibly the heat employed in the cooking of the beans was too low—or more probably continued for too short a time—to coagulate the albuminous constituents, which are essential to the production of the poison.

[1] *Médecine Légale*, trad. par E. Levy, 1881, p. 502.
[2] *Med. Times and Gaz.*, 1878, i. p. 37.

Reviews.

Clinical Chemistry. By C. H. Ralfe, M.A., M.D. Fcp. 8vo., pp. 308. London: Cassell & Co. 1883.

The general aim and plan of this volume is decidedly good, but unfortunately the execution does not compare favourably with the excellence of the intention. Taking what is perhaps the least serious defect first, we notice that a considerable number of misprints occur, and some mistakes which should certainly have been eliminated by a careful revision of the proofs. Thus, "fibrinoplasti*n*" is written throughout "fibrinoplasti*c*," and "hæmatopo*r*phyrin" appears everywhere as "hæmatopo*p*phyrin." Again, on p. 29, under glucose, "oxide" of copper should be "*sub*oxide," and on p. 81, "nitr*ous* oxide" should be "nitr*ic* oxide." Simple misprints occur on pp. 11, 35, 77, 79, 84, 163, and elsewhere. In the next place, the work contains many statements which are either wrong or insufficient and misleading. Maltose is mentioned on p. 175, but there is no special description of this substance in the earlier part, although it is now generally regarded as the sugar chiefly formed by the action of diastase and saliva on starch. The action of these ferments is represented on pp. 20 and 30 as leading to the formation of dextrin and glucose, maltose not being mentioned. On p. 53 indol is regarded as a product of normal pancreatic digestion; this is, however, corrected on p. 217. The statements on p. 74 of the nature, relations, and properties of the stroma and colouring-matter of the red corpuscles can scarcely be regarded as satisfactory. The red corpuscles are said to be formed of a "delicate membrane, *stroma*, which contains the colouring-matter," and other constituents of the corpuscles. Hæmatin (p. 81) is not what is usually described as a crystalline body. On pp. 103, 186, the curdling of milk by gastric juice is ascribed not to the specific action of any "rennet" ferment, but to the preliminary formation of lactic acid, which then causes the curdling. The fact urged in support of this statement is curiously inapposite, and Hammarsten, who is quoted in connexion with this, is the very observer who has proved, as we think conclusively, that the curdling is not due to any formation of lactic acid. Peptones are correctly classed among the proteids in Chapter II., but on p. 186 they are stated "when quite pure" to "give no reaction with Millon's test, or the

xanthoproteic reaction;" that is to say they are not proteids, since all true proteids do give these reactions. To take one more case, it seems scarcely wise, in discussing the relations of the bile and urinary pigments, to rely chiefly upon the views advanced by MacMunn, differing as they do in so many respects from those of other entirely trustworthy observers, to the exclusion of the views and experiments of the latter. Indeed if the several portions of this book are put together which treat of the relations of the colouring-matters of blood, bile, and urine, the result is a confused and confusing statement, and is much less conclusive than the known facts seem to warrant. It would not be difficult to give further instances of parts which would be the better for revision and correction, but perhaps enough has been said. There is, on the other hand, a considerable mass of good sound information in this work, and it is a pity that the value of this should be so largely diminished by the defects we have pointed out. Careful revision and correction might make a later edition quite a useful book for elementary students.

A System of Obstetric Medicine and Surgery. By Robert Barnes, M.D., and Fancourt Barnes, M.D. Vol. I. 8vo., pp. 592. Illustrated. London: Smith, Elder, & Co. 1884.

THE authors of this work have taken the opportunity of collecting and presenting in a systematic form Dr. R. Barnes's numerous and valuable researches. These may be expected to form even a larger portion of the succeeding volume, which will deal with the mechanism, natural and morbid, of parturition; and the accidents and diseases, with their treatment, of parturition and the puerperium. In the first volume, which includes a description of the anatomy, physiology, and pathology of gestation, the authors have followed the plan recently adopted by writers on the much wider subjects of general medicine and surgery, namely of obtaining contributions from persons whose special investigations or experience enable them to write with authority on certain limited subjects. The most important of these in this volume is the chapter on embryology, by Professor Milnes Marshall, and were we of opinion that the minute details of this difficult subject were really in place in a work on obstetrics, we should be inclined to place this section amongst the most valuable parts of the work. But here it is out of place, and of less value than it should be, for no one wishing to study embryology will consult a work on obstetrics, and few studying obstetrics will take the trouble to read the chapters on embryology. And we would make a like remark with regard to the long and needlessly minute description of the anatomy of the mamma. Of still less value is the contribution of Mr. Noble

Smith, on the teratology of the fœtus. It is a mere outline of the subject, unnecessary to the general reader, and far too superficial to be of use to the student of this branch of pathology; and it does not even contain a sufficient description of those cases of hermaphroditism, about the sex of which a cultivated obstetrician should be able to give a correct opinion. There is a short but important contribution by Mr. Henry Power on the retinitis which often accompanies the albuminuria of pregnancy. We hope that in a subsequent edition this may be extended and rendered still more complete. The chapter on the albuminuria of pregnancy is one of the best in the volume, and deserves careful study. This subject is one little known, we fear, to the general body of practitioners, and but very imperfectly treated of in previous works on obstetrics. Other valuable information on subjects hardly even mentioned in earlier works is given in the chapters on chorea, diabetes, and acute liver-atrophy in pregnancy. The pelvis, as would be expected, receives due consideration, and the length of its description is fully in accordance with the importance now attached to an intimate knowledge of its structure and physics. We do not know from what source the authors have obtained the measurements given on page 179, but we think that they are all in excess of average measurements. It is rare to find an undeformed pelvis with a bi-ischial diameter of more than 4·25 inches, and the measurements on page 185 are so strange as to indicate an error in copying. The work when completed, will, we feel sure, take a very prominent position among obstetric manuals, and London students will have no longer to look to Scotland or America for a first-rate text-book of this subject.

On Insanity and Nervous Disorders Peculiar to Women. By T. More Madden, M.D. Dublin: Fannin & Co. 1884.

Dr. More Madden, in this pamphlet, attempts to show that, "amongst those fifty thousand patients who are scattered through the various female lunatic asylums of the United Kingdom there are needlessly and improperly confined many women suffering from reflex nervous disturbance consequent on peri-uterine irritation or disease." He thinks that this should be provided for by the appointment of gynæcologists as special medical visitors to such asylums. If all other kinds of specialists were to advance a similar plea how many physicians would there be to each lunatic asylum? The better plan would be to advocate a greater breadth in the education and scope of the medical superintendent, so that he might be able to deal with all the causes which influence the onset and the continuance of insanity.

Clinic of the Month.

Paralysis by Suggestion.—MM. Richer and Gilles de la Tourette have made a study of the hysterical state of paralysis by suggestion which has already been commented on by Russell Reynolds, Erb, Bernheim and others. Such neurotic persons as are liable to the state of trance are also subject, either while somnolent or in their waking periods, to this form of temporary paralysis. The same is true, however, of some who are not thus liable, and even who are not usually hysterical. The paralysis presents, with but small variation, the characters of that from organic lesion, and its types range between the extremes of contracture and flaccidity, the latter being most easily studied in its various relations. If a suitable subject be chosen and enjoined that he should not, or even distinctly told that he cannot, move a limb, it falls inert by his side, and one can then note in it: (1) Complete flaccidity with abolition of motion and sensation. (2) Marked exaggeration of tendon reflexes, the number and force of the jerks as measured by the myograph being both much increased. (3) " Spinal tremor." This is best seen in the lower limb, but is evident also in the arm on forced extension of the hand. (4) Abolition of muscular sense. (5) The muscle-jerk in response to induced electricity is more tetanoid than that of normal muscle, its wave is higher and has a more prolonged descent. (6) The jerk produced by the continuous current at the making of the circuit with the negative pole showed these characters in a greater degree. It was twice as high as before or after the paralytic state, was much prolonged, had a flattened summit, and had a sudden fall. (7) Vaso-motor changes, as sensation of cold subjective and objective, and ready blushing on slight stimulation of the skin. M. Bottey (*Progrès Médical,* March 22) mentions hallucinations, temporary paralysis of sense organs, besides that of ordinary sensation and motion, as having been produced by him by the same method. M. Bernheim (*Progrès Médical,* April 5) has noted similar phenomena, and has marked their characteristic inconsistency, the special symptoms varying with forms of suggestion. (*Progrès Médical,* March 29, 1884.)

Electricity in Chronic Rheumatism.—Professor Seeligmüller claims to have met with remarkable success in the treatment of chronic articular rheumatism by electricity. He uses a metallic brush-electrode with stiff wires, which he connects with the negative pole, the positive pole being attached to a flat sponge electrode. The latter is damped and placed on the limb near the affected articulation, then the metallic brush is applied over different parts of the joints, being held in contact with the integument in each place for the space of from one to ten seconds. The application is very painful, but the professor remarks that the patients soon grow used to it. After a sitting the skin is covered all over with little dots, looking as if the Baunscheid instrument had been employed. The mode of action the author does not explain, but thinks it cannot be entirely owing to the counter-irritation, for he has used other equally severe cutaneous irritants without meeting with anything like the success obtained by this method. One patient, who had been treated for eight years for chronic rheumatism by all sorts of methods, was able after the first application of electricity to raise his arm, which had been powerless for six months; after the third application all the movements were normal. Another man was unable to move either his wrist or his shoulder, owing to rheumatism, and after five sittings was discharged as cured, and was able to resume his work as a stone-mason. (*Deutsche med. Woch.* Oct. 17, 1883.)

Amount of Albumen in Dropsical Fluid.—Dr. Runeberg finds that the exudation in a case of pure cachectic ascites is always clear, almost colourless, with at the most a slightly yellowish tint, and perfectly fluid. It is never quite clear, but always more or less opalescent and sometimes very much so, almost like milk and water. The turbidity does not depend upon the admixture of fat, nor of a large amount of formed material. It is probably due to some modification of albumen. It is not due, as Hoffmann believes, to the great dilution of the exudation, for the œdematous fluid removed from the intercellular tissue of a similar patient is clear like distilled water, although it is quite as much diluted as the ascitic fluid. This opalescent colourless fluid of the transudation in cachectic ascites gives to it quite a peculiar characteristic appearance. Such a transudation contains only very small traces of formed material, and no distinguishable red blood-corpuscles. In cases of portal obstruction the transudation has a variable appearance according to the amount of albumen it contains. In those cases where this is very small—under 1 per cent.—the fluid has an opalescent appearance, and a clear yellow colour, so that it may closely resemble a cachectic transudation,

but it is never so completely colourless, nor so milky-looking. When the amount of albumen is larger, the transudation is of a dark-lemon or straw-yellow, and is quite clear. White blood-corpuscles are always present to a moderate extent, and red corpuscles are seldom absent on microscopic examination of the precipitate, although they do not occur in sufficient quantity for their presence to be recognised by the appearance of the fluid. In general venous engorgement, the transudation has usually a darker, sometimes a brownish colour, and contains red blood-corpuscles in larger quantities, although they are seldom so numerous as to form a distinct red precipitate, even when the fluid is allowed to stand for a length of time. In general this kind of ascitic fluid resembles that of portal obstruction in the large amount of albumen it contains. The transudation in simple chronic peritonitis is quite clear, of a lemon-yellow colour, somewhat viscid, and contains numerous white corpuscles, and so many red ones that when the fluid stands for a length of time a thin red stratum forms at the bottom of the vessel. It also contains some fibrin, which coagulates in flakes. In carcinomatous peritonitis, the transudation has usually a very peculiar constitution. It contains formed constituents in such quantity that it has a turbid grey dirty look. When it stands for some time, the formed constituents sink gradually to the bottom, the fluid becomes gradually clearer until it is quite clear and yellow, like that of a simple chronic peritonitis, or that occurring in venous obstruction, with much albumen. The precipitate consists chiefly of cells which are many times the size of white corpuscles: they have a more or less uneven rounded form, generally contain one or more vacuoles, and closely resemble the swollen endothelial cells which are to be found in gelatinous infiltration of the lungs. Besides this a tolerable quantity of small white round cells occur and numerous red blood-corpuscles, sometimes in such quantity that the transudation has a hæmorrhagic look. Fibrin is seldom absent, but is rarely present in quantity; it coagulates in scattered loose flakes. The author has found the swollen large cells in large quantities in every case of carcinomatous ascites, and never found them of the same quantity or of the same size in any other form of ascites. The exudations removed after death are generally turbid from the presence of epithelial cells, and are of a darker colour than those removed during life, but there is very little difference in the amount of albumen they contain. (*Deut. Archiv f. klin. Med.* p. 1, vol. xxxiv.)

The Diagnosis of Mitral Constriction.—Simple mitral constriction is of far more frequent occurrence than is generally allowed, and its diagnosis probably presents greater

difficulties than any other serious lesion of the valves on the left side of the heart. We exclude from consideration cases which are complicated by regurgitation, because the latter, when advanced enough to produce grave symptoms, is easily detected; and the presence of constriction as well in such cases is not of great practical importance. But when, as not rarely occurs, the question is whether stenosis of the mitral orifice be present, and the cause of serious symptoms, or whether the heart be healthy, and the distress and danger due to other conditions, accurate diagnosis becomes a matter of the utmost moment. In a typical case the observer feels a thrill at the apex preceding the impulse of the heart; he hears at the base a clear second sound over the aortic valves, an exaggerated one to the left of the sternum, and at the apex a rolling præsystolic murmur, gradually increasing in intensity and leading up to a short and sharp first sound, which is not succeeded by any appreciable second sound. The diagnosis of mitral stenosis under such circumstances admits of little doubt. But in a second series of cases both murmur and thrill may be absent, and the heart's action regular, and the difficulty of detecting the disease then becomes great. The most striking auscultatory phenomena are accentuation of the second sound at the base to the left of the sternum, and, what is of much greater importance, a peculiar hesitation in the production of the first sound, a kind of "hanging fire," which is easier for the experienced auscultator to appreciate than to describe. Whatever be its origin, whether it be a faint sound caused by the blood passing through the constricted orifice into the ventricle, and so practically a murmur, or be due to a slowly beginning, though suddenly ending, ventricular contraction, it is a phenomenon which at once strikes the ear and suggests the nature of the disease. In these and all other cases of suspected constriction of the mitral orifice, the detection, if possible, of increase in size of the left auricle and right side of the heart, yields valuable corroborative evidence. There is a third class of cases, in which there may be no murmur, no thrill, no hesitating first sound, but extreme irregularity of cardiac action, the beats being very frequent and very irregular both in rhythm and in force; so much so that a great many of them produce no pulsation at the wrist. In some cases as many as half the beats of the heart are not felt in the radial artery, so that the pulse there may be moderate in frequency, although the cardiac contractions succeed each other with extreme rapidity. Similar phenomena may likewise be observed in cases of simple dilatation of the heart with degeneration of its walls, such as occurs, for example, in chronic bronchitis and emphysema; but then the patient is usually past middle life. If grave cardiac symptoms be found in a comparatively young person, and if auscultation only reveal

extreme irregularity in the heart's action, the presence of mitral stenosis ought to be at once suspected. The administration of digitalis in such cases not only often removes the patient's distress, and produces regularity and normal frequency of the heart's beats, but also facilitates diagnosis. For when the heart's action gets slow and regular a præsystolic murmur frequently makes its appearance. Finally, there are cases of considerable mitral constriction which produce no sufficiently well-marked morbid phenomena to enable the observer to detect the presence of heart disease. But the pathologist not infrequently meets with these narrowed orifices in the *post-mortem* room in patients who have died from other diseases. The reflection is then forced upon him, how extreme some pathological conditions require to be before they come within range of our present powers of diagnosis. (*Med. Times*, Jan. 5, 1884.)

Virchow on the Gouty Kidney.—An interesting address was given to the Berlin Medical Society, at a recent meeting, by Professor Virchow (*Berl. klin. Wochens.* No. 1, 1884), upon the relations of gout and renal disease. He first of all dispelled the erroneous idea that gravel and calculus have anything to do with gout. He then showed that gouty—*i.e.* uratic—deposits often occur without the patient ever having been the subject of a definite acute paroxysmal attack of the disease; and he pointed out the distinctions between the chronic latent form and arthritis deformans, having only once met with the uratic deposit combined with the peculiar joint condition of the latter affection. The gouty condition depends on imperfect nitrogenous metabolism, and may either be due to the excessive ingestion of nitrogenous food, or to a special disposition to defective elimination of nitrogenous waste. The "gouty kidney" is characterised by a deposit of urate of sodium within the tubules of the medullary portion; but the degree of the renal affection bears no constant relation to the amount of tophaceous deposit about the joints. Indeed, there may be no gouty arthritis present at all, and yet the kidneys be affected. It may be that there is an essential difference in these two classes of cases, but as yet no other condition than that known as the "gouty" and marked by an excess of urate of sodium in the blood is known to produce either the articular or the renal deposit. The kidney is also the seat of chronic interstitial nephritis—puckered and wasted—the wasting involving medulla as well as cortex. Virchow has never seen an *acute* nephritis which from the presence of the uratic deposit could be referred to gout. He points out that the chronic inflammatory change starts in the cortex, at a distance, that is, from the seat of the urates in the medullary tubes; just as in the joint, the urates occur in the

cartilages and ligaments, whilst the synovial membrane is the seat of inflammation. From this he argues that it is not the presence of the crystals, but the exudation of the fluid containing the uric acid in solution that acts as the irritant; the surfaces in contact with the secretion that are inflamed, and not so much those in which the salt is finally deposited. And here he adduces as evidence an illness from which he suffered towards the close of 1882. He had never had any attack of acute gout, but from time to time he suffered from slightly reddened and painful swelling of the fingers, interfering with movement. In the course of 1882 he began to suffer from an irritable bladder, with occasional febrile attacks, which passed into considerable irritation of the urinary organs, with pyuria, ischuria, &c., and he was made very uneasy by being told one day that, in addition to the pus, albumen and renal tube casts had been detected. The renal pelvis, bladder, and prostate—in fact the whole urinary tract—seemed to be in turn affected by some irritant. One day he bethought him to examine the pus, which was passed in large amount, to determine its source, and to ascertain whether it came from a mucous surface only. On adding acetic acid to the deposit to ascertain the presence of mucus, he was surprised to see the whole microscopic field covered with uric acid crystals to an amount which he had never seen before. Yet there was no suspicion of gravel or calculus, and he rightly inferred that this excess of uric acid indicated energetic alkaline treatment. This he at once commenced, taking biborate of sodium and Carlsbad water, with almost immediate disappearance of the uric acid crystals from the urine. He continued the treatment for three months, and has never passed any pus, albumen, or casts since. He could give no other explanation than that the blood and urine being highly charged with urates in solution, had acted as irritants to the whole urinary tract, exciting a purulent catarrh—in fact, an inflammation analogous to that which occurs in gout when urates are deposited in the tissues. A few remarks upon the physical and anatomical differences between calcareous deposits in the kidney and the urates closed the communication. (*Lancet*, Jan. 12, 1884.)

Treatment of Syphilis in Sucklings.—Link, after quoting the experiments of Labourdette and Dumesnil, which show that in animals 25 per cent. of iodine administered passed off in the milk, relates a number of cases tending to show that syphilis in sucklings may be successfully treated by giving iodide of potassium to the mother. (*Präger med. Wochenschrift*, August 8, 1883.)

Malignant Pustule communicated by a Fly.—A patient was bitten on the cheek by a large black fly. The

bitten spot in a few hours began to itch violently, but no swelling appeared until the next day. The characteristic appearances of anthrax infection speedily developed. M. Mollière, who had charge of the patient, destroyed the pustule by means of the thermo-cautery, and then injected the swollen parts, including the submaxillary gland, with a 20 per cent. solution of carbolic acid The patient recovered. A few filaments of *bacillus anthracis* were found in blood and serum drawn from the vicinity of the pustule, and a guinea-pig inoculated with the fluids died in a few hours with all the signs of specific infection. (*Gaz. des Hôpitaux*, No. 102, 1883.)

Elimination of Mercury in the Fæces.—Schuster states that in forty examinations of fæces mercury was found regularly in relatively large quantities during treatment by inunctions. Mercury was found in the fæces for five and a half months after the end of the mercurial course. The metal was found in the fæces in all the cases in which it was found in the urine; on the other hand, it was frequently not present in the urine when it was found in the fæces. The inference is that the elimination of mercury by the fæces is regular and continuous; that after extensive courses of inunction, say of from thirty to forty-five days, it is completed in six months; and that accordingly, indefinite persistence of mercury in the organism does not occur. (*Journal of Cutaneous and Venereal Diseases*, No. 12, Vol. 1.)

A Simple Operation in Facial Neuralgia.—Under this designation, Dr. Heustis, Professor of Surgery in the Medical College of Alabama, describes an operation which he performed on a gentleman above 70, who was in good health in all other respects except that he suffered from severe facial neuralgia, affecting both the infra-orbital and supra-orbital nerves. As the patient had become much weakened by the severity of the pain and his inability to eat his food, it was deemed desirable to render an operation performed upon the infra-orbital as simple as possible, consistently with its efficiency. "Therefore discarding Carnochan's operation of trephining the antrum, and following up the nerve beneath the orbit and removing it, and Langenbeck's slighter one of dividing the nerve with a tenotome, and drawing it out through the infra-orbital foramen, I merely cut down upon the foramen, and with a fine steel drill, such as dentists use, improvised of piano-wire, drilled out the nerve in its entire length, as far back as the spheno-maxillary fissure." The relief obtained was immediate and complete; and had so continued two months after the operation. (*Philadelphia Medical News*, Dec. 8, 1883.)

Salicylate of Bismuth in the Treatment of Typhoid Fever.—Dr. H. Desplats has treated a number of cases of typhoid fever with salicylate of bismuth (one part of salicylic acid to two parts of bismuth) with very satisfactory results. Even in the height of the disease the effect of the remedy upon the temperature is very evident. From 75 to 90 grains a day caused a reduction of temperature of about 5° F., beginning soon after the administration of the remedy. A larger dose than this was seldom given. When the drug was given continuously for several days, the reduction of temperature became permanent. The patient suffers at the same time a certain loss of strength, but the author never saw any dangerous degree of weakness occur. The remedy has no apparent influence upon the other symptoms, though in certain cases it seemed to have an aborting effect upon the disease. Dr. Desplats prefers it to the sodium salt, as it is less soluble, and probably on that account is less quickly excreted. (*Centralblatt. für klin. Medicin*, Nov. 17, 1883.)

Rupture of the Vermiform Process.—M. Polaillon, surgeon of the La Pitié, communicated to the Society of Medicine of Paris an interesting case of rupture of the ileo-cæcal appendage during an effort. A washerwoman, 19 years of age, and in the enjoyment of perfect health, while trying to lift a large bundle of linen, was seized with a sudden pain in the abdomen, accompanied by the sensation of something bursting. The pain kept increasing, together with great tenderness in the abdomen, especially on the right iliac fossa. Symptoms of intestinal obstruction appeared, and as no relief was obtained by the measures adopted the patient was brought to La Pitié on the seventh day after the commencement of the symptoms. By this time her situation had become very desperate, and an incision was made in the left inguinal region, in order to search for the seat of obstruction. A discharge of fœtid sero-purulent fluid announced that the intestine was already perforated, and that purulent peritonitis existed. Further exploration was not pursued, and an artificial anus was formed. The patient died ten hours after the operation, and abundant adhesions and suppuration were found at the autopsy. The vermiform appendage, in an inflamed condition, was found adherent at the upper aperture of the pelvis, and near its free extremity was an oval ulceration, in the centre of which was a rounded perforation; and a little distance above the ulceration a raw bean was found obstructing the calibre of the appendage but movable towards the cæcum. M. Polaillon observes that the case is remarkable as an instance of the rupture of the appendage by a mere effort, without any precursory signs, the

subject being quite well at the time. Still, even in the absence of symptoms, it is evident that the foreign body had effected such a change on the coats of the appendage as to diminish their power of resistance and prepare the way for a rupture. The case also shows that peritonitis may give rise to the three symptoms, gaseous distension of the abdomen, fæcal vomiting, and the absence of the emission of gas *per anum*, the union of which generally indicates intestinal obstruction. The error in diagnosis, however, is more apparent than real, for the adhesions arising from peritonitis may readily cause obstruction of the intestinal canal. (*Union Méd.*, Jan. 3. 1884.)

Water in the Dietary of Young Children.—In a communication to the *New York Medical Journal* (September 29), Dr. Remsen, of the Nursery and Child's Hospital, calls attention to the general ignorance which prevails as to the necessity of furnishing infants with a sufficient quantity of water, especially in hot weather, and whether they are brought up at the breast, or artificially. For want of this, the fluid portion of any food introduced into the stomach is quickly taken up, leaving the solids too thick to be easily digested. They ferment and produce indigestion and colic, together with diarrhœa. As a consequence of the thickened state of the blood thus produced, excretion of sweat is arrested, and a state of collapse and hyperpyrexia is developed. In warm, dry weather, babies will drink cool water every hour or oftener, if it is, as it should be, offered them. The earliest sign of the water in the system being below its normal standard is a slightly depressed condition of the anterior fontanelle. This may be present in children apparently in perfect health, yet in whom a slight increase of temperature or the deprivation of the breast for a few hours, may give rise to sudden hyperpyrexia. Attention is, however, usually first aroused by the fretfulness of the child, a moderate rise of temperature and pulse, a hot, dry skin, and a constant desire to suck. If a free supply of water be given, and nursing restricted in frequency, these symptoms will often disappear completely and quickly, but if not, collapse will soon come on. The temperature ranges from 105° to 106° F., or higher; the pulse is small and thready, numbering from 180 to 200; the skin of the body is painfully hot, while the extremities are cold; the features are pinched and sunken, with the eyes half-closed and the pupils contracted; the fontanelle is depressed, the hands are tightly shut, the respiration is hurried and irregular, and consciousness seems abolished. A child in this state will swallow water with greediness and the utmost pleasure. The treatment adopted at the Nursery has been wrapping the patient in a wet sheet,

applying cold to the head, and giving as much water as can be swallowed. The results have been very satisfactory, the child becoming quiet, and even going to sleep, while all the threatening symptoms rapidly subside. "The attention given to this point as a prophylactic measure has been followed by a diminished rate of mortality, and a marked reduction in the number of gastric and intestinal complaints. If more care was taken to give children a proper amount of water, and restricting their hours of sucking or feeding, the mortality due to hot weather would decrease, and less would be heard about the troubles of teething." (*Medical Times*, Jan. 26, 1884.)

Scrofulous Ungual Dactylitis among Children.—Bruis states that— (1.) There exists among scrofulous children a special variety of ungual dactylitis. (2.) It is characterised especially by its slow progress and is accompanied by the elimination of the nail and the formation of ungual fungosities, probably of tuberculous nature. (3.) It has been confounded, and is often still confounded, with perionychia and the dactylitis which is observed in syphilis. (4.) The general treatment ought to be that of scrofula, but ordinarily this is not sufficient to complete the cure, and it is then necessary to remove the nail, and carefully scrape the fungosities. (*Thèse de Paris.* Abstract in *Journal of Cutaneous and Venereal Diseases*, No. 13, Vol. 1.)

Extracts from British and Foreign Journals.

The Air Douche in Diabetes.—M. Campardon speaks highly of the effect of an air-douche applied along the spine in cases of diabetes. The douche is used for five or ten minutes at a time over the cervical region, but also lower down the back. In one case the amount of sugar in the urine, 77·44 grammes, fell, after eighteen douches, to 36·65 grammes. In another from 18 grammes to 2·27 grammes after eight applications. In a third, after use of the treatment for eight days, from 102 to 68 grammes. Improvement of general health advanced *pari passu* with that of the urine. The visible effect of this treatment is to cause blanching with cup-like contraction of the skin, the temperature falls 1°, a rosy blush succeeds the pallor, and lasts for three or four hours, and is in its turn followed by free local perspiration. M. Campardon has made use of the same remedy at the epigastrium in a case of well marked dilatation of the stomach, with the effect of greatly diminishing the size of the viscus. M. Dupont, speaking on this subject, compares the air-douche treatment very favourably with the similar application of water. The principle of both methods is that of counter-irritation by a regulated shock applied to the vaso-motor system. (*Progrès Médical*, April 5 and 12, 1884.)

The Action of Alcohol on the Body.—Some recent researches by M. Dujardin-Beaumetz throw light upon the behaviour of alcohol in the body. In a series of experiments on swine in which the dose of alcohol varied from 1 to 2 grammes per kilogramme of body weight, he found the gross lesions characteristic of local irritation, intense congestion of mucous membrane both at the alimentary and respiratory surfaces. The symptoms of intoxication passing into torpor were accompanied by great feebleness and trembling of the limbs. The chemical action of the drug in the body appears to vary with the amounts imbibed. M. Dujardin-Beaumetz is led to think that when the dose is minute, alcohol is rapidly converted into acetic acid, which is

absorbed and combines with the salines of the blood. With medium doses a similar conversion takes place, the oxygen of the air in the lungs being largely drawn upon for the formation of the acid. Finally, if given in large quantities the acetous transformation still goes on, but the pulmonary oxygen being insufficient the blood-corpuscles are robbed by it of their supply to make it up. On the last hypothesis the author seeks to explain the tendency to hæmorrhages, and also the action of alcohol in lowering the body temperature. (*Progrès Médical*, April 5, 1884.)

The Bacillus of Cholera.—Those who have followed the several reports which Dr. Koch has made to the German Government on his search after the "germ" of cholera will be quite prepared to learn that in his latest, and sixth letter, dated Feb. 2nd, he declares his conviction that the bacillus which he first discovered in Egypt is entitled to be considered a specific and essential element in the disease. In this latest report he enters into fuller detail than hitherto upon the characters of the microphytes, and enunciates the reasons which have led him to the above conclusion. The shape of the bacillus is peculiar; it is not a straight rod, but is slightly curved like a comma; it is very mobile, and occurs in colonies of wavy masses. In gelatine it forms characteristic colonies, and causes, like so many of these organisms, liquefaction of the medium. The research included the examination of twenty-two cholera cadavers, and seventeen cholera patients, and in all cases this special bacillus was found in the intestine and in the rice-water stools. A set of "control researches" in cases of diarrhœa, dysentery, and arsenic poisoning —that is to say, under conditions of intestinal derangement most allied to that of cholera—failed to detect the bacillus. That the bacillus is not a mere concomitant of the disease, or a normal inhabitant excited to further development under the influence of cholera, was shown by the fact that in the early stages of the attack, when the evacuations are still fæcal, very few of these bacilli occur; but that as the stools become more watery, the bacilli are met with in abundance. They never occurred in the stomach, and were only twice found in vomited matters which, from their alkaline reaction, were obviously of intestinal origin. When, as often happens, death occurs in the reaction stage, the bacilli are found, not in the contents of the bowel, but within the mucous membrane and tubular glands—a fact which it will be remembered was one of the earliest fruits of the research in Egypt. Dr. Koch points out that in every respect these bacilli conform to the behaviour of other pathogenic bacteria. The failure, after repeated efforts, to inoculate lower animals with these bacilli is not considered by Koch as

detracting from the value of the discovery. He adduces the instances of typhoid fever and leprosy in which characteristic micro-organisms have been found, as examples of the same failure. Dr. Koch further relates some remarkable facts as to the multiplication of the cholera bacilli outside the human body—*e.g.*, in damp soiled linen; and the rapid manner in which they can be destroyed by drying. The importance of such an observation in prophylaxis is evident; equally important is the fact that they perish in very slightly acid fluids, only flourishing in alkaline; the inference being that they are liable to be destroyed in the healthy stomach, but that they may pass through uninjured when the gastric secretion is deranged. At the same time there may, he thinks, be conditions of the bacillus itself analogous to the "resting state" of other bacteria which may enable them to escape the action of the gastric juice; but this, as well as the possibility of their persistence as spores for lengthened periods outside the body, requires further research. No doubt the German Government will comply with Dr. Koch's request that he be allowed to continue his research in India during next winter. The enquiry has been so fruitful hitherto that we may look for its further development as likely to throw still more light upon the mode of origin and spread of cholera. [Compare *Practitioner*, xxxii. 225.] (*Lancet*, March 29, 1884.)

Vinegar in Post-partum Hæmorrhage.—Dr. Grigg recommends the use of vinegar in cases of *post-partum* hæmorrhage. A wine-glassful given after the placenta is expelled causes rapid contraction of the uterus and speedy arrest of the hæmorrhage. It should be given without water, and a smaller dose repeated in fifteen minutes if the effect be not well-marked. He regards it as better and safer than ergot. (*Brit. Med. Journ.* Jan 5, 1884.)

Physiological Action of Iodoform.—A full account of the physiological action of iodoform, with an exhaustive bibliography, written by Dr. Gaetano Rummo, appears in the *Archives de Physiologie*, Nos. vi. and vii., 1883. The following are the chief physiological facts which he brings out:

1. *Fatal Doses for different Animals.*—In frogs, 2 centigrammes are sufficient to cause death if administered by the mouth or injected into the peritoneal cavity. In guinea-pigs, death occurred in two or three days after a dose, similarly given, of 1·5 to 2 grammes. In rabbits, 2·50 to 2·75 grammes were required, while for a dog, weighing 10 kilogrammes, 4 grammes were found to be fatal.

2. *Action on the Frog's Heart.*—Iodoform, in moderate doses, lowers the force and frequency of the ventricular contractions, finally arresting them in diastole; but very small doses at first

increase the force of the ventricular systole. There is some resemblance to the action of veratria in this slowing of the heart. It is not antagonised by atropia, but excision of the pons Varolii destroys the cardiac action of the drug. If the heart be excised when the slowing is well marked it recommences to beat immediately, but not always quite so fast as before.

3. *Action on the Capillaries of the Frog's Web.*—Iodoform, given internally, produces first dilatation and then contraction of these vessels.

4. *Action on the Circulation in Mammals.*—Moderate doses first retard and strengthen the pulse, with a slight increase of arterial tension. Full doses (2 to 4 grammes for a dog) produce more marked slowing and enfeeblement, with a fall of blood-pressure, which passes off in four or five hours. After large doses the pulse is first slowed, then becomes quick and irregular, with convulsive respiratory movements. Section of the vagi prevents the development of these phenomena. The action of the drug is therefore in this, as is the other experiments, seen to be different in the early and the later periods after its administration.

5. *Action on Temperature.*—Small doses in the case of dogs have no effect. A dose of 2 to 3 grammes produces a *rise* of from 1° to 1°·50 Cent. (1°·8 to 2°·7 Fahr.); while 4 to 5 grammes produce a marked *fall* of 4° to 5° Cent. (7°·2 to 9° Fahr).

6. *Action on the Nerve-Centres.*—Iodoform during the first period of its action simply lowers the functional activity of the nerve-centres; it then diminishes and finally abolishes voluntary movements—especially in the frog—with some anæsthesia and diminished spinal reflex. It then lowers the excitability of nerve-trunks (that is, to external stimuli,) and power of muscular contractility. In the second period of its action it excites the nerve-centres, and produces clonic and tonic muscular contractions.

7. *Action on Vomiting, &c.*—In the dog small doses produce uneasiness merely. Full doses, as 4 or 5 grammes, are followed by vomiting and diarrhœa.

8. *Action on Secretion.*—Iodoform at first slightly increases the flow of saliva, bile, and succus entericus; later, the rate of secretion is much more largely increased.

9. *Mode of Elimination.*—Iodoform is eliminated in small quantities unchanged by the lungs; but chiefly as the alkaline iodate of sodium. It appears in the urine within an hour after its administration, and is present there for three days.

10. *Action on the Kidneys, &c.*—It is quickly removed in the form of the alkaline iodate, if the doses be moderate; but this salt is not formed if the quantity given be large. Elimination of the drug is then stopped, and albuminuria or hæmaturia occurs. The kidney passes into a condition of glomerulo-nephritis, while in addition there are general fatty degeneration, especially of the

liver, and inflammatory changes in the cord similar to those of acute polio-myelitis.

11. *Action on Development of Bacteria.*—Iodoform is more powerful in preventing the appearance of bacteria than in arresting their multiplication. It and its sodium salt, when dissolved in oil of turpentine, are readily fatal to all micro-organisms. (*Lond. Med. Record,* March, 1884.)

Jequirity: its Action and Uses.—The subject of jequirity ophthalmia, which has engaged the attention of ophthalmologists and others a great deal of late, receives a valuable contribution from Dr. Klein, in a paper published in the *Centralblatt für die medicinischen Wissenschaften* (8, 1884). A theory was propounded in the course of last summer by Dr. Sattler, that this peculiar form of ophthalmia had its origin in a special bacillus or its spores believed to be present in the jequirity infusion. Dr. Klein's experimental investigation of the question has led him to meet this theory with a direct contradiction. Taking all possible precautions to sterilise the infusions employed, and to render septic contamination impossible at any stage of his proceedings, he successfully injected portions of sterilised infusion into a clear cultivation material (solution of peptone), and beneath the conjunctivæ of the rabbit. The former was preserved in the usual manner at a given temperature, and after 24 hours showed no trace of turbidity or any evidence of the development of micro-organisms, whilst in the same lapse of time an intense ophthalmia was set up in the inoculated animals. After another 24 hours the microscope failed to detect any sign of a bacillus, either in the cultivation fluid or in the purulent discharges from the affected eyes, nor did the pus so discharged appear to have any infective power whatever. From these experiments it becomes clear that the active principle of the freshly prepared infusion has the power of producing ophthalmia independently of the presence of any micro-organism, and that the preliminary boiling of the infusion, which has been observed to render it innocuous, must not be attributed to the destruction of the bacilli as suggested by Dr. Sattler, but rather to the alteration of the active principle of jequirity which thus loses its fermentative action. Mr. Arthur Benson (Dublin) gave to the Ophthalmological Society (March 13, 1884) the results of a clinical investigation into the mode and manner of action of jequirity. He had found that the ophthalmia could be produced by (1) the fresh powdered seeds; (2) the freshly made infusion; (3) the infusion after bacilli had grown in it; (4) the infusion six weeks old, and swarming with micro-organisms of most varied types; (5) the infusion after these bacilli had lost all motion, and had sunk to the bottom of the liquid, apparently dead. He had examined at all stages of the

disease the discharges and membranes from eyes affected with jequirity ophthalmia, without ever seeing the typical bacillus. The inoculations of the discharges and membranes were entirely devoid of infective qualities. He was thus able to confirm Dr. Klein's researches. Mr. Benson used the fresh infusion made from the seeds not decorticated, but passed through a coffee-mill. He had a high opinion of the value of the treatment in granular lids, and had never seen any serious injury result from its use. In one case there was a short attack of iritis after each application, and in others some infiltration of the cornea occurred. (*Med. Times*, March 22, 1884.)

The Lateral Associated Movements of the Eyes.—The fact that the internal rectus of one eye acts with its fellow during convergence, and with the opposite external rectus during lateral movements of the eyes, long ago suggested that it had a double nervous supply. A good deal of light has been thrown on the subject of late by Duval, Graux, Laborde, Parinaud and others. In the *Liverpool Medico-Chirurgical Journal*, Nos. 5 and 6, Mr. G. A. Woods publishes a very thoughtful paper on the subject, in which he carefully reviews the anatomy and physiology of the sixth nerve, and analyses the symptoms in one series of cases where the nucleus of the sixth nerve was destroyed or damaged by disease, and another where the trunk of the nerve was so affected. His conclusions may be abridged as follows :—The sixth nerve appears in the human fœtus about the twelfth week, its apparent origin is from the groove which separates the anterior pyramidal body from the pons Varolii, it occasionally sends a small filament to the lenticular ganglion. It is essentially a motor nerve. If the nerve be divided between its apparent origin and termination, internal strabismus on the same side alone results. If the nucleus of origin be destroyed, there follows paralysis of the external rectus, with partial paralysis of the internal rectus of the other eye. Some of the fibres from the sixth nerve nucleus pass along the floor of the fourth ventricle, parallel with the raphe, to the third nerve nucleus, and then decussate and become incorporated with the third nerve on the opposite side. (*Med. Times*, March 22, 1884.)

The Influence of Large Quantities of Water upon Fever.—Dr. Wilischanin says that dogs, made feverish by the injection of putrefying defibrinised blood, were artificially fed with large quantities of warm water, their weight and bodily temperature being carefully noted. The following were the results obtained by Dr. Wilischanin :—1. The temperature fell under the influence of the imbibition of large quantities of water. 2. The deprivation of water in the later stages of the fever had also the effect of lowering the temperature. 3. The

animals became dull and sleepy under its effects. 4. The appetite increased under the administration of larger quantities of water. 5. The deprivation of water induced a diminution of bodily weight. In animals kept without water during the febrile state, granular degeneration of the kidneys, liver, and heart was found to a greater extent than in those supplied with excess of water. Of these organs, the liver most frequently had undergone this change. In some cases the lesion was so far advanced as to have extended to the nuclei of the cells, which were themselves atrophied. The heart was least affected, the change having only effected an obliteration of transverse striæ of the muscular fibres. (*Centralbl. für die med. Wiss.*, 38, 1883.)

Treatment of Sloughing in Hernia.—The *Deutsche med. Wochenschrift* of Nov. 7 quotes a lecture delivered by Dr. Riedel, of Aix-la-Chapelle, on the treatment of gangrenous hernia. He recommends that the gangrenous portion of intestine should be withdrawn from the sac, attached to the thigh by a few stitches, and then drained of its contents by a tube passed into the central portion of the bowel. After an interval, not exceeding twenty-four hours, during which the intestine should be kept moistened with naphthaline, resection of the gangrenous portion is proceeded with, without chloroform, and the external wound is carefully closed. The first part of the operation can be undertaken by any surgeon, and the patient thereby brought into a condition in which he may be safely transported within reach of more skilful aid. (*Lond. Med. Record*, Feb. 15, 1884.)

The Teeth in Inherited Syphilis.—In a very long paper published in the *Annales de Derm. et de Syph.*, Nos. 9 and 10, 1883, M. Fournier discusses in great detail the various changes in the teeth that may be found in subjects of inherited syphilis. The influence of the disease may be shown in two ways: 1. By delay in the evolution of the teeth; 2. By arrest of development and modification in structure—the origin of the consecutive malformations of the teeth. The first of these is of but slight value in diagnosis, and does not require any detailed description. It is the second class of changes to which M. Fournier devotes much attention, and which he divides into four principal groups, viz.:—1. Erosions of the teeth; 2. Microdontism, or abnormal smallness of certain teeth; 3. Dental amorphism, characterised by the fact that certain teeth lose, more or less, the proper attributes of the type to which they belong; 4. Vulnerability of the dental system, shown by rapid wearing, alteration, and early decay of certain teeth. To these four principal groups may be added some rarer peculiarities, *e.g.* irregularities of implantation, and anomalies in the position of the teeth in regard to one another. M. Fournier next puts forward

the following propositions. 1. The influence of inherited syphilis may be shown on both sets of teeth. 2. The milk teeth are—or, at least, appear to be—much less frequently influenced by syphilitic heredity than the permanent teeth. 3. Malformations of the teeth, due to syphilitic heredity are generally multiple and symmetrical (in the affected jaw). Erosions of the teeth are divided into two groups. *Group I.—Erosions of the crown of the tooth.* These are subdivided into (*a*) cup-shaped erosions (*en cupule*); (*b*) Facet-shaped erosions (*en facettes*); (*c*) Furrows (*en sillon*); (*d*) *Erosion en nappe,* which is simply an exaggeration of the preceding forms, *i.e.*, in which they cover a large surface of the crown (honey-comb tooth). *Group II.—Erosions of the cutting edge of the tooth.* These vary according to the kind affected. Thus, in the first molar (the only one which shows the influence of syphilis) there is true atrophy of the summit of the tooth (*atrophie cuspidienne* of Parrot). The canines may show two kinds of erosion, and the incisors at least five kinds. It is to the last of these five kinds, called here "Hutchinson's tooth," that the greatest importance attaches. Its chief characteristic is a semilunar notch in the free border. (A long account of this form of tooth, according to Mr. Jonathan Hutchinson's description of it, is then given.) Erosions may affect the temporary or permanent teeth, but much most frequently the latter. M. Fournier's opinion on the subject of erosions in connexion with inherited syphilis is as follows. 1. The dotted, cup-shaped, and facet-shaped erosions, as well as the serrated condition of the cutting-edge, have little or no value from a diagnostic point of view. 2. Erosion in the form of furrows (*erosion sulciforme* of Parrot), though of more value than the others, is not infrequently found without any syphilitic taint. 3. Atrophy of the crown of the tooth, especially of the first molar, has more significance. 4. The best sign, and indeed, an almost certain one, of inherited syphilis, is the semilunar notch of the free border (Hutchinson's tooth); and when this affects the median upper incisors it is a particularly valuable, but still *not pathognomonic,* sign of the taint. The other changes, viz., microdontism, amorphism, vulnerability of the dental system, &c., are next considered; but, like the erosions, none of them are pathognomonic of syphilis. Syphilis is not only capable of originating changes in the teeth, but clinical observation shows that it is one of the most active causes. The conclusion arrived at by M. Fournier is that, though the dental malformations in question should always lead to a suspicion of inherited syphilis, they are none of them in themselves conclusive evidence of it. (*Lond. Med. Record,* Feb. 15, 1884.)

An Improved Method of Amputating the Penis.—Surgeon-Major T. J. McGann gives the outlines of four cases of

amputation of the penis by the following method: The patient is placed on the table in the lithotomy position, and chloroform having been given, an assistant, holding the scrotum in both hands, draws it forwards, keeping the raphe of the scrotum and perineum in the same line. An incision of two and a half or three inches in length is made behind the scrotum in the median line, with its centre over the bulb; the corpus spongiosum having been completely exposed, and a little fine dissection made so as to separate it laterally from the corpus cavernosum, the scrotum is allowed to drop and is drawn slightly backwards, and the penis having been seized, is pulled forwards and removed by a single sweep of the knife close under the pubis. The few bleeding vessels having been twisted or tied, the scrotum is again drawn forwards as before, when the cut surface of the corpus spongiosum presents itself through the posterior incision, and this being separated from the corpus cavernosum, is turned down into the perineum, and left hanging out there half an inch beyond the level of the skin. The front and back incisions are then united by a few points of suture, and the protruding spongy body slit on the lower or posterior aspect, and the edges united to the perineal skin on either side by two points of suture. The operation is completed. On the completion of the operation there is but a small wound visible in front, and the scrotum, which is practically intact, has to be raised to render the posterior incision visible. (*Indian Med. Gazette*, Dec. 1883.)

Malformations of the Heart and Cyanosis.—At the close of a paper on this subject, Dr. David Newman, of Glasgow, draws the following conclusions:—It appears that the most important cause of cyanosis is obstruction to the flow of blood to or from the right side of the heart, and that the degree of the discoloration depends upon—(1) The time at which the obstruction became sufficient to give rise to cyanosis. The earlier the symptoms appear the more marked are they likely to be. (2) Free communication of venous and arterial blood in so far as it determines the resistance to the flow of blood to or from the right chambers of the heart, and the amount of blood carried to the lungs. (3) The amount of compensation established by a patent foramen ovale, or ductus arteriosus, or by a collateral pulmonic circulation. (4) The nature of the vessels and integuments—the thinner the vessels and other textures the deeper the hue. (5) The degree of hypertrophy of the right ventricle and the condition of the tricuspid valves. (*Glasgow Medical Journal*, Feb. 1884.)

Boracic Acid in Cystitis.—At a meeting of the Vienna Medical Society, Professor Rosenthal observed that boracic acid is little soluble in water (1 to 26), but that a solution in hot

glycerine (1 to 5) can be kept a long time without any fungus formations taking place. In cases of ammoniacal cystitis, in which balsams and turpentines are useful but exert a mischievous effect upon the intestinal canal, as do also salicylic and benzoic acids, and in a slighter degree chlorate of potassium—boracic acid given in doses of from one to one and a half grammes per diem acts as a mild acid and a good antiseptic, the urine at the end of several days becoming acid and free of bacteria. If two grammes are combined with 100 of water, and some glycerine or syrup of orange-peel is added, the patient will bear this daily dose for weeks, the bladder being washed out also with a two or three per cent. solution of the acid. (*Allg. Wiener med. Wochenschrift*, Jan. 15, 1884.)

Glycerine in Acute Fevers.—Professor Semmola calls attention to the use of glycerine as an aliment in the treatment of grave acute febrile processes, and especially in typhoid fever. Alcoholic drinks, he says, have only a pretended antiseptic action, which has deceived many eminent practitioners. In his opinion, alcohol produces a toxic action very much as do other antipyretics—veratrine, digitalis, carbolic acid, and salicylic acid —disproving the dangerous utopian ideas of some young physicians concerning the power of carbolic and salicylic acids, etc., to cure or abort typhoid fever. As to alcohol, on account of its exciting action on the heart and cerebrum, and its disturbing action on the digestive organs, Semmola has entirely discontinued its regular and constant use as an aliment in grave febrile processes, reserving this agent for combating threatening heart failure. Glycerine, on account of its chemical composition, long since appeared to Semmola as a substance which might replace alcohol in these fevers, and which would give the patients a greater resistance to the action of the fevers. He uses the following formula:—

℞.—Glycerine, pure. . . . f℥j.
Citric or tartaric acid. . ʒj.
Water . . . . . . ad. f℥xvj.—M.
S.—fʒv–viij every hour.

This solution is well borne by the patient; but sometimes, on account of its acidity, Semmola gives it at the hours for taking milk or beef-tea. In the rare cases in which the solution is unpleasant to the patient, he replaces the acid by a few drops of oil of anise. The principal therapeutic effect, and the only one upon which Prof. Semmola insists, consists in the quantity of urea eliminated. From an accurate observation of twenty cases of typhoid fever, he concludes that the diminution during twenty-four hours may amount to so much as ʒvij, and as a rule it is from 90 to 100 grains. He has proved by experiment that the

glycerine is an agent in this diminution. (*Journal de Méd. de Paris*, Dec. 22, 1883.)

Treatment of Gout by the Thermal Waters of Aix-la-Chapelle.—The advantage derived by gouty patients from the waters of Aix la Chapelle has long been known, and has been remarked more particularly by Garrod and G. Mayer. Mayer observed that after treatment patients frequently remained for a length of time without any attack. The mode of action of the thermal treatment has been investigated by Dr. Beissel, especially in regard to the influence of thermal douches on the organism. He kept a healthy man in hospital for several days under strict control, living constantly on the same diet and regularly following the same occupation. The douche was then applied, as is usual at Aix-la-Chapelle, for fifteen minutes over the whole body, and a bath at blood-heat was given afterwards for another quarter of an hour. An analysis of the urine showed that the amount of urea excreted in twenty-four hours was, on an average of three days before the bath, 37 grammes, on the three days during which the bath was applied 42·18 grammes, and on the three days after the bath 24·36 grammes. The excretion of urea on the first day after the bath had been stopped sank as low as 14·95 grammes, and then gradually rose. The excretion of uric acid was effected in a similar manner to that of urea; the average daily excretion before the baths was 0·87 grammes, during the baths 1·91 gramme, and after the baths 1·01 gramme. These numbers show that the excretion of both urea and uric acid is greatly increased by the application of the douches, and it would appear that some time is necessary before the excretion of these substances again attains the normal. The diminished production of urea and uric acid, which is an after-effect of the baths, may explain the beneficial results of the thermal treatment in gout, in which. according to Garrod, uric acid is probably the *materies morbi*. (*Berlin. klin. Wochenschr.* No. 13, 1884.)

Notes and Queries.

THOUGHTS ON PUERPERAL SEPTICÆMIA.—Dr. Atkinson writes:—"In my anxiety to be as short as possible in my remarks on the above subject in the *Practitioner* of March last, it appears that I have not made one or two points as clear as was intended. For instance, I would include puerperal peritonitis, pyrexia, and pyæmia under the same heading. I would further say that there is the greatest risk in those cases where the discharge subsequent to delivery is more profuse than natural, inasmuch as the uterus, being imperfectly contracted, often allows the retention of clots, &c. for a longer period than is desirable, and the internal surface of the organ is in a condition just suited for the absorption of any decomposing matter. (The cases which give least cause for anxiety are those where there is little, or next to no, discharge from the commencement, such as, for instance, often occurs after the introduction of the hand for the removal of clots or placenta). Mental anxiety is, no doubt, not an infrequent factor in puerperal septicæmia, inasmuch as it weakens nervous power, and so general muscular tonicity. Most cases of fever arise between the second and third days, hence I would suggest the use of the thermometer from the second to the fifth day as a regular rule, and the employment of the treatment proposed as soon as there is any decided rise of temperature or shivering."

Mr. C. T. Kingzett writes as follows:—"In the *Practitioner* for March (No. 189, vol. xxxii.) there is a note by Dr. Shelly respecting the uses of peroxide of hydrogen, in which attention is called to the investigations carried out by M. Miguet respecting the germicidal properties of this substance. I write to call attention to the fact that the antiseptic properties of peroxide of hydrogen were first investigated by myself, and my results were communicated to the Chemical Section of the British Association at its meeting at Glasgow held in 1876. Since that time the results of my researches have been confirmed in every detail by those of M. Paul Bert and his coadjutors, so that the investigations of M. Miguet have appeared the latest in the history of this subject. As respects the uses of peroxide of hydrogen in surgery I would call attention to an article which I contributed to the *British Medical Journal* of December 2nd, 1882, from the perusal of which it will be seen that the information conveyed by Dr. Shelly is not of a novel character. It is, however, none the less interesting as lending confirmation to facts previously well established."

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Department of Public Health.

OUTBREAK OF EPIDEMIC SORE THROAT, FOLLOWING USE OF MILK FROM COWS SUFFERING FROM APHTHOUS FEVER.

READ BY M. K. ROBINSON, M.D.,

President, at the Annual Meeting of the East Kent District of the British Medical Association, May 8th, 1884.

DURING the early days of the month of February in the present year, a remarkable outbreak of sore throat occurred in Dover, which, on account of the suddenness of the outbreak, the severity of the symptoms, and its chief prevalence amongst those occupying the best houses in the town, attracted no small amount of public attention; and naturally provoked a large amount of interest in the investigation as to the cause thereof.

Controversy on the subject waxed warm, especially when it became known that the course of the epidemic corresponded most intimately with the track of a particular milkman, and that the milk supplied by this man was believed to be the vehicle of the specific poison occasioning the epidemic.

On the one side were ranged those who had suffered most grievously from the tainted milk, and who therefore felt correspondingly indignant on the subject; whilst on the other side were those who, in the kindness of their hearts, sympathised with the poor milkman whose trade, they feared, would be ruined by the disclosure.

Within the short period of four days 188 persons were

attacked by this malady, which in its leading features presented a close resemblance throughout the whole series of cases.

The symptoms varied, of course, in severity, both at the onset of attack and in the sequelæ that followed; but the local inflammation of the throat, accompanied by enlargement of the lymphatic glands of the neck, was the prominent sign met with in the individuals attacked, vesicular eruptions preceding and accompanying the inflammation. During the week ending February 9th, 205 persons were attacked, all of whom obtained their milk supply from one particular dairy.

The houses in which these people resided were distributed in forty-two different streets in the town, widely separated from each other.

In nineteen of these streets (or nearly half of the whole number) every house supplied by this milkman was invaded by the epidemic, whilst, with one or two doubtful exceptions, no other cases could be heard of in the same streets, at any rate none of sufficient gravity to require the services of medical men. Thus the striking fact was exhibited of an exact correspondence between the milk supply and the houses invaded by the epidemic.

In the remaining twenty-three streets where this milk was delivered, out of eighty-six houses supplied, fifty-one were invaded by the disease.

The number of persons attacked in each house stricken averaged 2·5 per house.

In thirty-one houses there was only one case in each, in twenty-one houses two cases in each, in fifteen houses three cases in each, in seven houses four cases in each, in five houses five cases in each, in three houses six cases in each, in one house seven cases, and in another nine.

In addition to various degrees of susceptibility possessed by different individuals, there were other circumstances which would account for the escape of some of the dairyman's customers, whilst others suffered. In the first place, he delivered special milk, obtained from healthy cows, separately from that milk which had been blended with the infected milk; thus at one house an officer and his family had a special supply of milk, in a sealed can, obtained from the dairyman's own cows, which

were perfectly healthy, whilst the servants had their milk from the mixed milk : the servants suffered, the family escaped !

There was also a separate supply of what was called "nursery milk," for which a higher price was charged, and this also, was unblended milk : at houses thus supplied the inmates escaped, unless cream (*all* of which the dairyman obtained from the implicated source) was also purchased and taken, as it often was, with fruit at luncheon or dinner, or in tea.

A marked feature in the epidemic was the manner in which the servants suffered, and this was accounted for by their admission that they had not only, in many instances, partaken of the infected cream, but were large consumers of the milk also.

From the almost simultaneous character of the outbreak, especially during the first three days, it was clear that some common cause was at work in the production of a crop of cases so closely resembling each other; and when it was found that the houses in particular streets, distributed over different parts of the town, which were supplied with milk from a particular dairy, were the houses selected by the epidemic visitor, it became apparent that the milk, as in many previous epidemics, was acting as a vehicle of disease.

My own experience, which extends back to 1872, in connexion with the propagation of disease by milk, has chiefly been where outbreaks of enteric fever and scarlet fever have been diffused through contamination of the milk with the specific poisons of these diseases. I have however notes of cases when disease in the human subject has been developed after the drinking of milk from diseased cows, but never to the same extent as in the present epidemic.

For the purpose of ascertaining what particular taint was present in the milk, which was calculated to occasion this particular epidemic, a searching inquiry was made, and the following facts collected. The implicated dairyman obtained his supply of milk from twelve cows kept on his own premises at Dover, and also from three farm establishments in the country. All these places were visited, and diligent search made for any evidence of disease amongst either the cows, or people living or engaged on the premises.

At one of these establishments in the country it was found that aphthous fever had broken out amongst the stock on January 14th, and that milk from some of the affected cows was delivered to the Dover dairyman, and, after being mixed with other milk, distributed to his customers. Moreover, it was from this infected farm alone that the Dover dairyman obtained the supply of cream furnished to his customers.

At the beginning of the inquiry it was stoutly denied that any of the milch cows had suffered from disease, and a certificate from a veterinary surgeon and inspector to this effect was obtained and published. Recourse was had to the police, and the truth gradually oozed out, until the facts, as above stated, were established beyond dispute; then, the farmer not only admitted the fact of the disease amongst the milch cows, but confessed to the sale of their cream and milk in Dover not only to the dairyman whose milk was specially implicated, but also to another milkman, on two separate occasions, amongst whose customers a second simultaneous outburst occurred; thus—a second experiment was performed with this tainted milk amongst another set of individuals with like results to the first, contributing (if such corroboration was necessary) additional evidence of the presence of poison in the milk supplied from the infected farm. Thus it was clearly established that the sufferers in this epidemic partook of milk which had been secreted by cows suffering from foot-and-mouth disease, an epizoötic malady typically characterised by vesicular eruptions and soreness of mouth and feet, but, like human diseases, constantly presenting all manner of variations, from the most simple, and often unrecognised attack, to the malignant form, which was noticed in the summer of 1872, in some herds of Iceland cattle which were brought to Leith and Edinburgh in that year.

Bearing upon the question of varieties of type in human epidemics, Dr. W. B. Carpenter, in one of the most instructive and thoughtful articles that has recently been written on the germ theory of zymotic diseases, says:—

"It has been too much the habit of pathologists, in scientifically defining specific types of disease, to follow exactly the same course as the species-maker amongst naturalists—insisting on minute differences rather than on points of agreement, and assuming that differences are constant. Every practitioner of

medicine, on the other hand, who has had opportunities of observing the same diseases in different localities, at different seasons, and in different individuals, well knows how greatly their characters vary; 'hybrid forms' and 'sub-varieties' presenting themselves from time to time, which receive passing notice and then die out. Thus, although no eruptive fevers are more clearly differentiated, when occurring in their characteristic forms, than measles and scarlatina, yet cases every now and then occur in which their symptoms are so mingled as to puzzle the most experienced doctors. I even remember such a hybrid disease to have been epidemic some thirty years ago in the east of London; and as Sydenham, one of the most sagacious medical men that ever lived, did not separate the two, I cannot but think it probable that this 'hybrid' was the disease prevalent in his time. Again, the small-pox epidemic of 1871, and subsequent years, has been characterised by the re-appearance of the 'malignant' type of that disease, which had not previously shown itself in Europe, except in a few isolated cases, during the present century. The whole course of that 'hæmorrhage' type, when presented in its most characteristic form (in which death occurs before the appearance of the eruption), is so entirely different from that of ordinary small-pox, whether 'confluent' or 'discrete,' that the two diseases might be accounted specifically different, if it were not certain that they originate in the same *contagium*."

The majority of persons who suffered during the Dover epidemic presented two prominent symptoms in common, viz., inflammatory sore throat and enlargement of the lymphatic glands; but the lesions produced varied considerably in different cases.

The vesicular eruptions were followed either by a raw, red, œdematous appearance of the mucous membrane or white patches, and the ulcers which supervened assumed, in many instances, a chronic character, with thick puckered edges, and were a long time in healing.

When the inflammation of the tonsils went on to suppuration recovery was much slower than after common quinsy, and the enlarged cervical glands remained tender, red, and swollen long after the throat symptoms had subsided, resembling, in this respect, the sequelæ of scarlet fever. Erysipelas and purulent formations were concomitants, also, of the epidemic.[1] In some instances the feet of those who suffered were swollen and painful, simulating rheumatism; and in one case eczema occurred between the toes of the feet, the affection being accompanied with very fetid exhalation.

A fatal termination resulted in the cases of two children, who had very bad throats and mouths, with the extension of the

[1] See *British Medical Journal*, Nov. 13th, 1869, for cases described by Mr. Bride as simulating the effect of inoculation of a septic fluid.

disease, in one case, to the respiratory tract, their deaths being, in the opinion of the medical attendant, due to the poisonous effects of the milk.

Two persons, who laboured under chronic kidney disease, were respectively attacked with sore throats and died on the same day; other people in the same houses suffering, also, from the epidemic sore throat.

In one house, three persons were attacked, on the 4th February, with sore throat; one of these was a servant girl, who was sent home and seen by the hospital surgeon on the 9th at 12 A.M. and died at 4 P.M. Mr. Wood gives the following history of the case:—

> "F. S. attacked five days previously with sore throat and pains in the limbs, complained on the 8th of great pain in the epigastric region, and dyspnœa. There was a purple red patch on the left cheek, extending to the nose. At 3 P.M. on the 9th, she passed into a state of coma, and died at 4 P.M."

Mr. Wood says this was an obscure case, but thinks it possible that it was one of blood poisoning.

Instances of the effects of this tainted milk upon domestic animals were narrated to me; but I can verify only one from personal observation. This was a dog to which a quantity of the milk in an uncooked condition was given to drink. The symptoms which this animal portrayed were a blistered and inflamed condition of the mucous membrane of the lips and mouth, and inflammation of the skin and cellular tissue between the toes of one foot, terminating in suppuration.

The preceding description contains, I believe, a fairly accurate account of the facts relating to this epidemic.

In extent and severity the outbreak exceeds, in a marked degree, any previous records of the results which have followed the use of milk from cows suffering from foot-and-mouth disease. It is, however, quite possible that many obscure epidemics of throat disease may have been occasioned by a similar cause to the above, although the history may not have been sufficiently clear to have established the fact. Dr. Eade of Norwich and many others have had a strong suspicion that this is the case, and there is no doubt that epidemics of sore throat have been more prevalent during and following the increase of foot-and-mouth disease in the country.

The official returns show that 461,000 cases of foot-and-mouth disease were returned in 1883, against 37,000 in 1882. The difficulty of obtaining truthful evidence is exemplified in the history of this epidemic. If I had been content with the first statement of the farmer, that his cows had not suffered with the foot-and-mouth disease, or with the certificate of the veterinary surgeon to the same effect, the salient point in the history of this epidemic, viz., the existence of disease amongst the milch cows, would still have remained in obscurity. Mr. Power, in concluding a report to the Local Government Board on an outbreak of sore throat of a diphtheritic character at Hendon, last year, due to infected milk, refers to the coincidence of ropy character and infectiveness in the milk, &c., and after saying that the farmer was explicit in stating that none of his cows had been suffering from disease (a statement fortified by the certificate of a veterinary surgeon), concludes his report with this very terse statement upon the evidence respecting the freedom from disease amongst the cows:—

> " Such assurance might be entirely comforting, but for a growing misgiving to the effect that ailments of animals, so trivial as to be disregarded or even unnoticed by people about them, may have larger concern with occurrence of specific disease in the human subject than has heretofore been thought likely."

With regard to this Dover epidemic, there appeared to be not only a special infection in the milk, but a septic poisonous influence exerted on those who drank it.

In considering a cause for this condition of the milk, it becomes necessary to revert to the source from which it was derived.

The diseased cows and stock were kept in low close sheds surrounding a small yard, which was full of decaying manure, rotting turnips, and the infected excreta, so that the specific poison, after elimination from the animals, would, instead of living structures, have for its pabulum decomposing and putrefactive organic matter, swarming doubtless with the bacteria attending these changes.

That milk absorbs with great facility volatile matter is a well-known fact, and on these premises the milk and cream especially would be tainted, first, from the infected cows directly, and secondly, from an atmosphere laden with germs fed on animal

and vegetable substances undergoing putrefaction; such milk would possess a peculiarly tainted character, and would therefore be calculated to produce the specially poisonous effects noticed during the epidemic.

That the specific organisms of various zymotics may undergo modification, according to pabulum and environment, is only in accordance with what is observed throughout the animal and vegetable kingdom.

The conviction that scarlatina poison, after residence in sewers or cesspools, obtains the power of inflicting the various lesions seen in throat affections, particularly those approaching a diphtheritic character, has long forced itself upon the minds of many observers, from the fact that over and over again such manifestations of the disease have occurred in localities visited previously by scarlatina, when facilities existed for the storage of this fever poison in some sewage collection, and its subsequent liberation and diffusion therefrom.

In an epidemic of sore throat, which broke out in the early part of this year in a village about twenty-five miles from Dover, four recent outbreaks of foot-and-mouth disease had occurred, and the chief supply of milk was obtained from one of the farms where this epizoötic had occurred. The yard, surrounding the cowsheds and abutting on the dairy, was piled up with dung and filth, which must have been charged with the poison of the disease, and the milk therefore would be liable to absorb the virus.

In one of the first houses invaded, the father of the children had been engaged in turning over the infected manure, and many of the children attacked had to pass the manure, which was spread out close to the public road.

The eruptions about the lips and alæ of the nose were very similar to that noticed in persons who had drunk milk from aphthous cows; but the appearances in the throat approached nearer the diphtheritic character.

There was no evidence of recent importation of either scarlet fever or diphtheria; the only specific poison that appeared to have established a habitat in the locality, was that of foot-and-mouth disease; and, from the history and characteristics of the epidemic, there was reasonable ground for believing that the

source of the poison was derived from cattle, the medium, in this case, being their infected excrement.

I have referred to the last mentioned outbreak here, because a record of the facts observed during its investigation may, in connexion with the foregoing description of the Dover epidemic, help to elucidate some of the difficult problems involved in the etiology of throat affections.

SOME CAUSES OF INFANT MORTALITY.

Amongst the reports which have been issued somewhat recently in connexion with the health of various sanitary districts, there are several which contain valuable, and at times significant, information as to some of the causes of high infant mortality. Taking England and Wales as a whole, 14·9 per cent. of the children born alive in the ten years 1861 to 1870 died, according to the English Life Table, before completing the first year of life, the percentage in certain recognised Standard Districts being 10·2. These so-called Standard Districts may be taken as fairly representative of ordinary mixed urban and rural populations, for, in addition to rural areas, they include urban populations varying from some 4000 to 5000.

These rates are, however, greatly exceeded in certain specified districts. In the north-western counties of England infant mortality has always been high, and during the decennial period 1861 to 1870, the percentage of deaths under one year to registered births in Liverpool amounted to 23·3. The conditions under which this excessive infant mortality occurs have often been the subject of inquiry. In 1862 Mr. Simon drew the attention of the Privy Council to the fact that in different districts of England there were numerous differences of infantine mortality—such differences that the children in some districts died at perhaps four and five times the rate of children in other districts, and he stated his belief that these wide differences of death-rate were mainly due to the varying prevalence of two local causes; first, to differences of degree in common sanitary defects of residence, some places abounding more than others

in "the foul air and foul water of undrained, unpaved, unscavenged, unwashed, unlighted, unventilated localities and houses; and secondly, to occupational differences among the inhabitants, there being much difference in the extent to which women engaged in various branches of industry were kept away from home and where consequently the home was ill-kept, the children were but little looked after, those infants who should be at the breast were improperly fed or starved, or had their cries of hunger and distress quieted by fatal opiates." All that was then written on this subject remains true to the present day, and whilst but little has been done to remove the conditions leading to excess of infant death, additional evidence turns up from time to time to show not only how unnecessary this loss of life is, but how certain practices which are common amongst the poorer classes tend in an indirect way to maintain it. Amongst these we may specially name the failure of parents to procure medical advice as to sick and dying infants, a practice which is revealed by the number of uncertified deaths; and the practice of insuring the lives of infants in burial or benefit clubs. Grave sanitary defects about dwellings also continue to further this mortality. As to these points, we would draw attention to the following reports.

The first relates to the sanitary condition of Ashton-under-Lyne. It is from the pen of Dr. Ballard, and it well illustrates how some of the grosser conditions obtaining in many of our large towns prejudicially affect infant life. Amongst the matters which deserve consideration in that town, he refers to—

"1, the specially high mortality among infants and children, reaching to this, viz.: that it has been the rule in Ashton that, speaking broadly, only about four-fifths of the infants born complete a year of life, and only about two-thirds of them five years of life; in some years the mortality has been greater than even this statement indicates, for example, in 1874, 1875, and 1880. 2. The fact that 45 per cent. of the deaths of infants under a year old are referred to a group of causes which may be regarded as synonyms for parental debility or disease, neglect of maternal duties, habitual improper feeding, drugging, aud such unwholesome domestic surroundings as operate with special energy on the tender constitution of young infants, while about a quarter of the rest were the result of diarrhœal diseases which, in unwholesome localities, are apt, in the summer season particularly, to make terrible havoc of infant life."

It is there pointed out that in Ashton the years of highest general mortality have been those of high child mortality, and

of greatest mortality from diarrhœa and the infectious diseases of children. The conditions which, in addition to the character of the mass of the population and the nature of their occupations—occupations which largely involve the employment of women in mills and workshops—appear to have exerted so marked an influence upon the death-rate of the town, are summarised as follows :—

"1. The nature of the soil of the town and its neighbourhood, for the most part highly retentive of moisture and rendering the atmosphere habitually damp, and in the winter cold and foggy also. 2. The fact that the effect of this natural condition is not counteracted so well as might be by good paving of roadways and yards. 3. The density of some of the older parts of the town. 4. The narrowness of the blocks of houses in the newer as well as in the older parts, leading to defective aëration of the centre of the blocks. 5. The lack of due sewer ventilation with, in some parts, the existence of facilities for the sewer air entering dwelling-houses, and in some parts the total absence of proper means of carrying away liquid refuse."

And as the result of these conditions the deaths under one year of age have, on an average, reached 19·3 per cent. of the registered births, the rate having during recent years occasionally amounted to nearly 25 per cent.

The next report we would refer to is one by Dr. Franklin Parsons, on the sanitary condition of Spennymoor. This is a small urban district in Durham, having a population of some 6,000 ; wages appear fairly good there, work is easily procurable, the inhabitants seem prosperous, and women are not, as a rule, employed away from their homes. In short, the district is one where the rate of infantine mortality ought not to exceed that prevailing in the Standard Districts. But during the eight years 1876 to 1883, the deaths under one year of age reached an average rate of 19·6 per 100 births. As regards uncertified deaths, it appears that these are steadily on the increase, that they have varied within recent years from 24 in 1880 to 38 in 1883, that during the past four years 23 per cent. of the total deaths registered have been uncertified, and yet that during this period only ten coroner's inquests were held. Speaking of the general high death-rate of the district, Dr. Parsons says :—

"It is mainly due to the excessive mortality among children. Considerably over half the deaths are those of children under five years. This, again, is probably connected with the high birth-rate, coupled with the unfavourable sani-

tary and other conditions under which the children who are born are placed, and to which many of them succumb. The proportion of children who die in their first year is a third part greater in Spennymoor than in England and Wales. In 1883 the registered causes of deaths of the infants who died in their first year were—convulsions, 16 ; bronchitis and pneumonia, 15 ; diarrhœa, 11 ; wasting diseases (marasmus and tabes mesenterica), 8 ; congenital causes (premature birth and debility), 6 ; infectious diseases (measles and whooping cough), 3 ; others, 4.

"In connexion with the high death-rate from diarrhœa, I may mention, as probably an important factor in it, the prevalence of excrement nuisances all over the town, and more especially the frequent proximity (sometimes only two feet) of open middens to the latticed windows of the pantries in which the food is kept. The effluvia from the middens entering the pantries can hardly fail to taint the food, especially milk, and render it unwholesome.

"The ultimate causes of a high infant mortality are commonly as much social and moral as sanitary. In Spennymoor the Medical Officer of Health attributes it to the intemperance of parents, and the consequent bad housing, bad feeding, and bad clothing of their families ; to the reckless exposure of children to infection by gossiping mothers, and to the use of farinaccous foods for infants instead of milk.

"The following observations received from him in a letter possess a melancholy interest :—

"'A frequent cause of infant mortality in Spennymoor is the feeding of infants on artificial food from their birth ; bread, corn-flour, rusks, and patent foods being the principal articles used. With regard to milk, there is a fair supply, but for its quality I cannot say much.

"'Another cause is the exposure to cold and the occupying of damp unhealthy houses. A great number of women with children who live in bad houses spend a great deal of their time in public-houses. It is certainly disgraceful at the week's end to see the number of women with children who, very often along with their husbands, spend the best part of a Saturday night drinking.

"'A number of women here have the habit of either eating or drinking opium. If their husbands happen to be working at night they become lonely, and one teaches the other the habit of laudanum drinking or eating powdered opium ; this must injure the mother's milk, and the child at the same time gets neglected or is given food to try to keep it quiet. Another cause is the use of soothing syrups ; these save the mother the trouble of nursing the child.

"'Also where there are a number of children very frequently the mother employs a young girl of 11 or 12 years of age to nurse the baby. As there is no field or park to go into while the mother is cleaning up the house, the girl very often takes them into the back yard, where they can only amuse themselves amongst the middens, drains, privies, &c.'

"The Surveyor and Inspector says: 'I have noticed great negligence on the part of the parents ; children may be seen at all hours of the day running about with nothing on but a small body shirt, and in a most deplorable state of dirt, and from what I have seen there is no doubt that in many cases their food is badly prepared and very irregularly supplied.' 'The women generally are very much given to gossiping and running into each others' houses ; consequently the doors are left open, and the children may be seen in the coldest days in winter playing in the draughts that are plying between the open doors, and in the majority of cases only half clad. It is also a common thing for the mothers to take half of their clothes to the pawn shops on the Monday morning and let them stay until the Friday night or Saturday, when the men's wages are paid.'

"Moreover, I am told by persons who are in a position to form a correct judgment, that in their opinion there can be no doubt that the prevalent habit of insuring the lives of infants, by giving the parents a direct pecuniary interest in their death, tends to affect injuriously the amount of care and solicitude which they receive. Of fifty-eight children under five years old dying in 1883, respecting whom inquiries were made by the surveyor and inspector, in forty cases the parents received benefit from a club or insurance society, the amounts received varying from 15*s.* to 6*l.* It appears that the lives of children may be insured before they are born, and that it is only necessary for them to live long enough to be baptised to entitle the parents to receive the sum payable on their death. In one case a child three weeks old was insured in three separate clubs; in another 2*l.* was received on the death of a child who lived only an hour; in another 1*l.* was received on the death of a prematurely born child who only lived twenty minutes.

"It is noteworthy as indicating the little care which children receive, that in this mining district more than half of the deaths from injury during the past eight years have been those of children under five years old; the two in 1883 were both those of children who were fatally scalded by falling into tubs of boiling water. Twenty of the thirty-eight uncertified deaths in 1883 were of infants under one year."

The danger to infant life arising from insurance in burial and other clubs is also dealt with in Dr. John Lowe's annual report for 1883 on the sanitary condition of Workington, in Cumberland, another district where female employment cannot be alleged as tending to infant death. Speaking of the high rate of mortality amongst children, he says:—

"I have before ascribed the high infant mortality to neglect, starvation, exposure, and dosing with opiates. Burial clubs are doubtless, in a great measure, responsible for this mal-treatment. It is not unusual for a child to be in two or three burial clubs, and when the child's parents are degraded through drunkenness, and crime, and poverty, the inducement to get money by allowing the child to die, which these clubs afford, but too often determines the child's existence. I believe burial clubs to be the most cruel and fatal institutions in this country, as they strike at the foundation of national prosperity through the demoralising influences which they not only develop but sustain."

So also Dr. A. Campbell Munro, medical officer of health to the borough of South Shields, first deals with this question from the point of view of ignorance as regards feeding, and then expresses an opinion very similar to that already quoted.

"As the result," he says, "of my inquiry, I am satisfied that there is a very considerable waste of infant life in South Shields, arising in large part from the ignorance of mothers as to the proper regulation of infantile diet, resulting in a very general administration of starchy food which the children are utterly unable to digest, and which simply acts as an intestinal irritant; indeed, I found that tender infants had in many cases been getting what was called 'the run of the house' which, on further inquiry, was found to include potatoes, herrings, steaks,

&c. I think the extent to which the artificial suckling of children is carried on in Shields is inexcusable, considering that the female population, and especially the matronly element, is but to a very slight extent employed in public works. And I am of opinion that the very general system of insuring the lives of infants is an unfortunate circumstance sanitarily, whatever may be its economic relations."

From these extracts it is evident that amongst the conditions leading to high child mortality in various parts of England, many are of a class which do not, as a rule, come directly within the cognisance of sanitary authorities and their officers, and that the action necessary for their prevention lies rather in the adoption of measures tending to educate and elevate the lower classes than in the enforcement of mere sanitary regulations. The sale of poisonous narcotics under the guise of names which in no way indicate their dangerous character, the extent to which deaths are uncertified, and the operation of clubs in furthering high rates of infant mortality are, however, conditions which will not be effectually dealt with without some legislative interference.

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